

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

EDISON PROGRESS

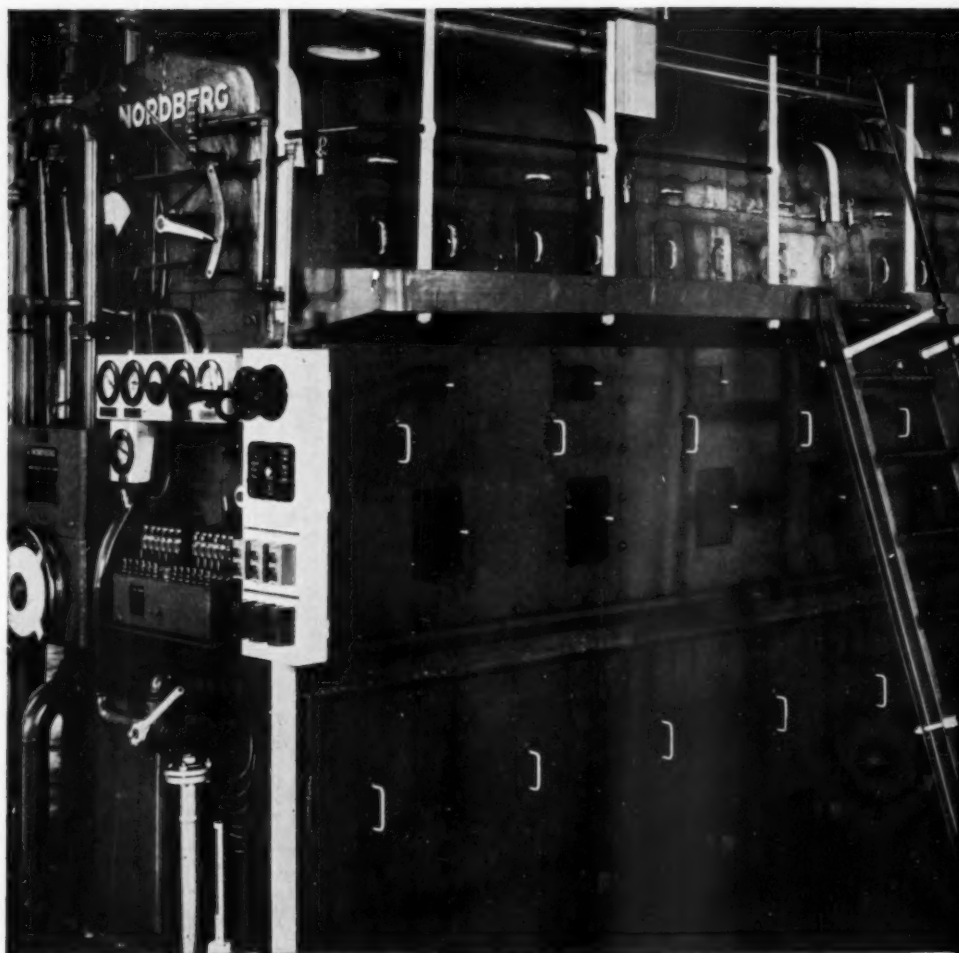


FIVE DOLLARS PER YEAR

MAY, 1951

FIFTY CENTS PER COPY

ASSURE THRIFTY




TUNE IN...
TEXACO STAR THEATER
starring
MILTON BERLE
on television
every Tuesday night.
See newspaper for
time and station.



TEXACO

POWER



Lubricate your engines with **TEXACO URSA OILS**

When you use *Texaco Ursa Oils* in your Diesel, gas or dual-fuel engines, you get full power *plus* real economy. *Texaco Ursa Oils* assure this because they resist oxidation, stand up under heat and pressure and keep engines clean . . . free from harmful sludge and carbon.

This means free rings, open ports and properly functioning valves for better compression and combustion—less fuel consumption. Wear is reduced . . . bearings and all moving parts last longer . . . maintenance costs go down.

Texaco Ursa Oils are available in every needed viscosity and are approved by leading engine manufacturers. Their fine performance has made them America's favorite. In the Diesel field alone—

More stationary Diesel h.p. in the U. S. is lubricated with Texaco Ursa Oils than with any other brand.

A Texaco Lubrication Engineer will gladly help you protect your Diesel investment with effective lubrication. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

URSA OILS

**FOR ALL DIESEL, GAS
AND DUAL-FUEL ENGINES**

P&H DIESEL ENGINES



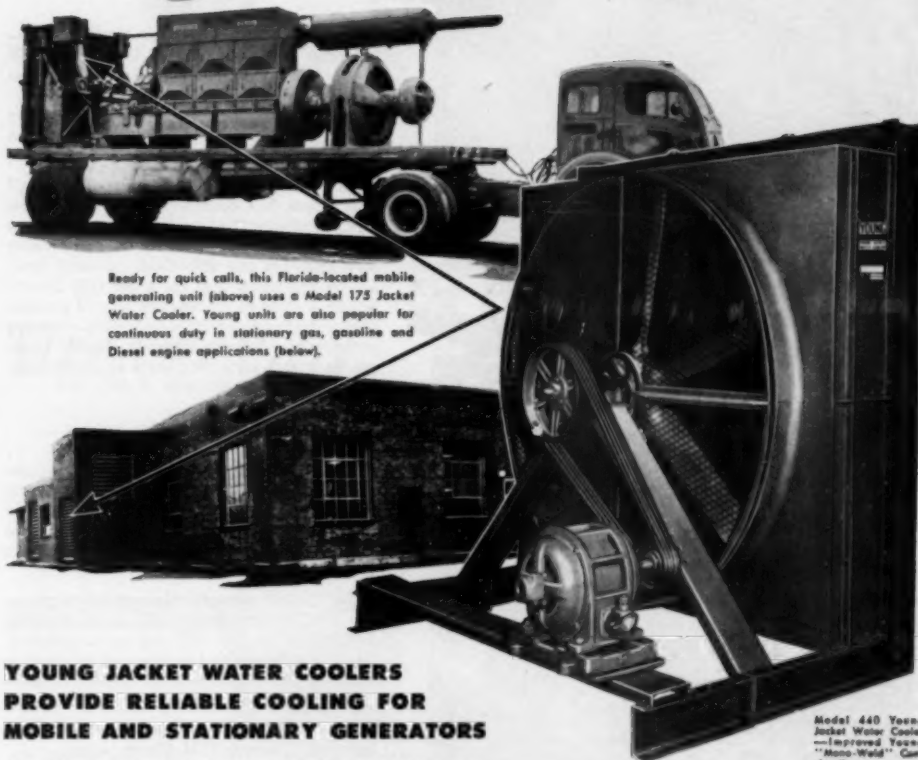
MINUTES...NOT HOURS!

REPLACE THIS COMPLETE CYLINDER ASSEMBLY

Here's something you can't do with any other diesel. The P&H cylinder assembly (comprising head, liner, piston and rod) fits *any* P&H Model — 1, 2, 3, 4 or 6-cyl. It's built as a unit; stocked as a unit; installed as a unit — anywhere — in minutes . . . not hours or days! Think what this can mean to you in time and money saved. No wonder more and more diesel users are standardizing on P&H Diesels. For literature, write Diesel Division, Harnischfeger Corporation, Port Washington, Wisconsin.



KEEPING ENGINES COOL IN AN *Emergency!*



Ready for quick calls, this Florida-located mobile generating unit (above) uses a Model 175 Jacket Water Cooler. Young units are also popular for continuous duty in stationary gas, gasoline and Diesel engine applications (below).

YOUNG JACKET WATER COOLERS PROVIDE RELIABLE COOLING FOR MOBILE AND STATIONARY GENERATORS

Intermittent service and the stress and strain of mobile equipment are rigid tests for any cooling unit. Young Jacket Water Coolers are a favorite for such duty because they are ruggedly built, reduce failure experience—are always ready in an emergency.

Extra strength is now built into every Young Jacket Water Cooler. From the "Mono-Weld" welded steel top and bottom tanks, vertical tubes, and steel center support, to the heavy steel channel framework, they're built for the life of the power plant. Oil and/or gas cooling coils may be mounted between the fan and liquid cooling core. Catalog No. 1351 will soon be off the press. Reserve your copy today.

Model 440 Young Jacket Water Cooler—Improved Young "Mono-Weld" Construction.

YOUNG

Heat Transfer Products
for Automotive and Industrial Applications.



Heating, Cooling, Air
Conditioning Products
for Home and Industry.

Reg. U. S. Pat. Off.

YOUNG RADIATOR COMPANY

General Offices • Dept. 401-E • RACINE, WISCONSIN
Factories at Racine, Wisconsin, and Matteson, Illinois



1000 YARDS EVERY SHIFT

ON one of the northwest's toughest highway jobs—relocating 4.4 miles of U. S. 2 along the steep sidewalls of rocky Pine Canyon, near Wenatchee, Washington—Goodfellow Brothers, Inc., assigned the most difficult hauling to 3 GM Diesel-powered 16-ton Tournarockers.

"They are working out *very* satisfactorily," said James B. Goodfellow. Powered by 186 H.P. 6-cylinder "71" engines, the rear-dump Tournarockers hauled 9 to 11 bank yards each trip. On one 2800-foot, one-way haul, job records show that the three GM Diesel-powered units easily handled shovel production of 1000 yds. every 8-hour shift—helping to keep the job on schedule despite steep grades, rough haul roads and confined hauling conditions at altitudes of 2000 feet.

Power at Every Downstroke

There are good reasons for this performance—rugged design and precision manufacture, two-cycle operation, a smooth flow of plenty of power, quick acceleration and the always-ready-to-go qualities of General Motors Diesels.

These engines are offered as standard or optional equipment in over 500 kinds of power machinery by 120 different manufacturers. They are backed by the experience gained in building more than 315,000 Series 71 units totaling over 48,000,000 horsepower.

For any equipment you buy or re-power, it will pay to specify GM Diesel power.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES... Up to 275 H.P. DETROIT 28, MICHIGAN MULTIPLE UNITS... Up to 850 H.P.

GENERAL MOTORS

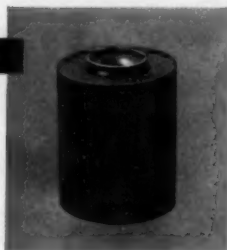
DIESEL BRAVN WITHOUT THE BULK





Protection PLUS *for Diesels*

FOR FUEL FILTERS



As protection for fuel injectors and transfer pumps, AC Elements are unequalled. They are engineered for factory-equipment Diesel fuel filters—and are precision-built to AC's highest quality standards. These AC Elements have been proved by millions of hours of service. Your engines need this *plus* protection to assure reliable operations.

FOR LUBS OIL FILTERS



AC Lubricating Oil Filters and Elements are standard equipment on GMC Truck and Coach, Flexible Bus and Detroit Diesel engines.

Replacement elements are available for nearly every make of lubricating oil filter—some made of cellulose and some of AC's new *Aluwac* filtering material. Either type gives your engines protection *plus*.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

"ONLY CLEAN OIL IS SAFE OIL!"

MADISON-KIPP *Automatic* LUBRICATION

DRIVING SPEED REGULATED TO MACHINE SPEED

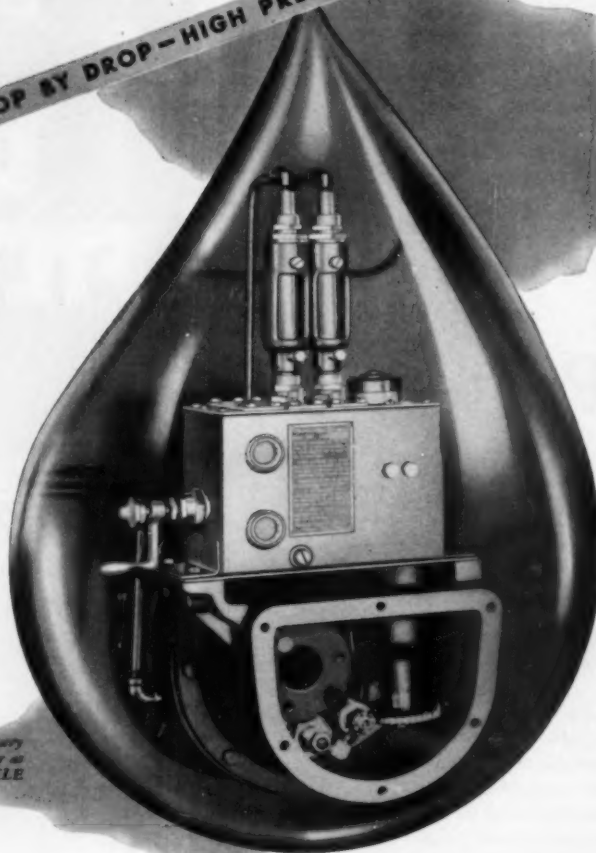
MEASURED FEED - DROP BY DROP - HIGH PRESSURE DELIVERY

HERE is a close-up illustration of an actual application of a Bottom Rotary Drive Model SVH Madison-Kipp Lubricator. The operator's responsibility is reduced to a minimum. The machine manufacturer has given his customer a life-time plus value.

Madison-Kipp is the most dependable method of lubrication ever developed and there are models to fit almost every original equipment requirement with automatic drives to fit every application.

Engineering details are, of course, yours for the asking.

Madison-Kipp Bottom Rotary Drive Model SVH Lubricator as applied to Ingersoll-Rand XLE Compressor.



MADISON-KIPP CORPORATION

• 215 WAUBESA STREET, MADISON 10, WIS., U.S.A.

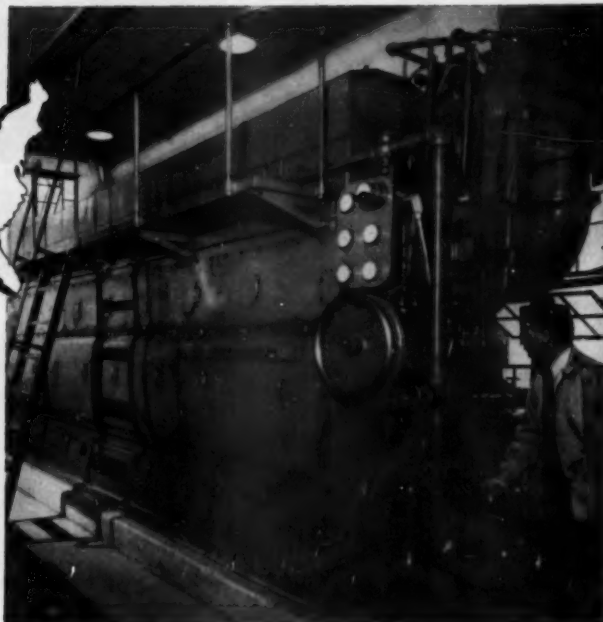
ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- Skilled in DIE CASTING Mechanics
- Experienced in LUBRICATION Engineering
- Originators of Really High Speed AIR TOOLS

How are things
in Mora, U. S. A.?

Rates Cut, Profits UP!



Things are as good in Mora, Minnesota as the song says they are in Glocca Mora. Worthington Diesel engines operated by the municipal power plant in this progressive community have helped produce the lowest electric rate of any full Diesel municipal power plant in the state.

A Worthington 4-cycle supercharged engine, operating at low load factor of 42.6%, produced in 1950 5% more power per gallon of fuel than a 2-cycle engine operating at 59.4% load factor. Following the installation of the Worthington engine, rates were cut in 1949, yet net profits, in 1950, were greater than ever.

Worthington four-cycle supercharged

engine is particularly well suited to the needs of a growing community like Mora—whose peak kw load has increased an average of 11% a year in recent years. Even when over-powered, a plant can operate at very low fuel cost and have the added engine capacity when needed without additional investment.

When you buy a Worthington 4-cycle supercharged engine, you benefit, too, from the longest experience of any manufacturer with this type of engine. For any engine application, call on Worthington—an engine for any fuel: oil (crude or regular), gas or "dual fuel". Worthington's complete line of engines assures you of the

most economical operation no matter what fuel you use.

If gas or any combination of gas and oil offer fuel economies, consider Worthington gas or dual fuel engines. Only Worthington offers such exclusives as dual plunger pumps, gas micro-metering valves for each cylinder and thermal air controls—all built to give optimum performance for the fuel used.

For further details of the dependable, economical Diesel performance that proves there's more worth in Worthington, contact Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.

WORTHINGTON



**ECONOMICAL
CONTINUOUS POWER**
Diesel Engines, 150 to 2640 hp
Gas Engines, 190 to 2880 hp
Dual Fuel Engines, 245 to 2640 hp

WORTHINGTON-BUILT AUXILIARIES



Bilge Pump
Compressor



Oil Transfer
Pump



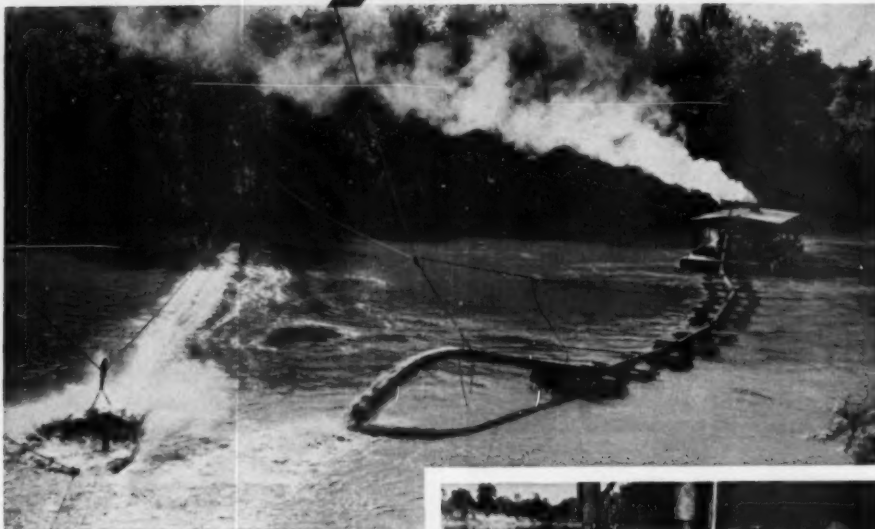
Cooling Water
Circulating Pump



Compression Type Engine
Water Cooler

E.1.10

All Day Sucker



ROADS FROM RIVER BOTTOM! UD-24 Diesel power pumps sand and gravel to be used for highway improvement in Arkansas and Missouri.

Big International UD-24 sucks 1,400 cubic yards of sand and gravel every day from Black Rock river

Hour after hour this International Diesel forces a high-pressure stream of sand and gravel through a 200-foot pipe to the river bank. "The UD-24 does the job fine and has enough surplus power to run all the extra barge equipment," says owner R. C. Tate, Black Rock, Arkansas. "And the engineers like its quick starts and easy maintenance."

Steady performance and big working capacity of International engines make them favorites where low-cost, non-stop power is needed.



POWER FOR PUMPING PROFIT is furnished by this UD-24 Diesel. Owner R. C. Tate is mighty pleased with this unit.

Get the whole story on these profit-making power plants from your International Industrial Distributor or Power Unit Dealer. Take a look at his stock of approved parts and efficient service facilities. You'll find out why Internationals give you dependable, profitable power for years to come.

INTERNATIONAL HARVESTER COMPANY
CHICAGO 1, ILLINOIS

INTERNATIONAL



POWER THAT PAYS

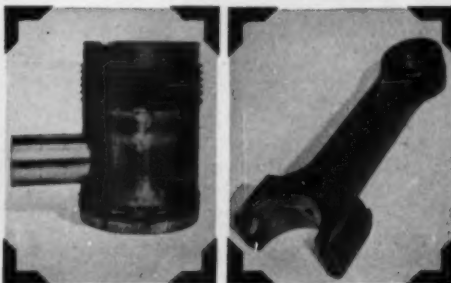
STANDARD ENGINEER'S REPORT

	DATA
LUBRICANT	RPM Delo Oil R.R.
UNIT	Alco Diesel - 6 cyl. 12 1/2" x 13" - 1000 H.P.
SERVICE	Mountain haul - Heavy snow, extreme cold
LOCATION	Spokane, Wash. - Yakke B.C.
FIRM	Spokane International R.R. Co.

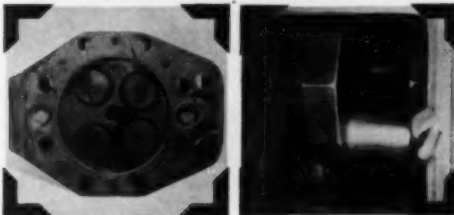
Engines in "perfect condition" after year of toughest service!



LUBRICATED WITH RPM DELO Oil R.R., nine new diesels owned by the Spokane International R.R. Company were kept in regular service for one year. The winter was exceptionally severe and the locomotives bucked heavy snow almost daily. They worked or were idled in temperatures that often for periods of ten days averaged from 20 to 40 degrees below zero.



On inspection at the end of that time there were no accumulations of sludge in oil systems and the engines were in "perfect condition" as pictures of parts from one of them indicate.



NO CARBON had collected on the cylinder head and all rings were free and functioning properly. Connecting-rod and main bearings and wristpin were within standard tolerance. Measurement of the liner showed less than 0.001 inch wear.

REMARKS: The Spokane International Railroad provides an important connecting service between transcontinental lines through Spokane and the Canadian Pacific to the north. Most of their trackage is in northern Idaho where severe weather and other conditions often make operation difficult. RPM DELO Oil R.R. will meet the toughest weather or operational conditions in all locomotive diesel engines.



How RPM DELO Oil R.R. prevents wear, corrosion, oxidation



- A. Special additive provides metal-adhesion qualities... keeps oil on parts whether hot or cold, running or idle.
- B. Anti-oxidant resists deterioration of oil and formation of lacquer... prevents ring-sticking. Detergent keeps parts clean... helps prevent scuffing of cylinder walls.
- C. Special compounds stop corrosion of bushing or bearing metals and foaming in crankcase.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Barber, N.J., Chicago, New Orleans

STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado



MAIN LINE OF SUPPLY!

ONE of our country's most important military assets is the fleet of General Motors Diesel locomotive units now in service on the main lines of America's railroads. Railroad demand for this power has increased with the national emergency.

Although General Motors Diesels comprise less than one-sixth of the nation's locomotives, they are hauling 33% of the total freight ton-miles on U. S. railroads today.

As compared to steam engines, Diesels average 64% more ton-miles of work per hour.

They average three times as many hours per day!

Diesels haul longer trains on faster schedules—

and require far less time out for maintenance, servicing and refueling. With Diesel power, every train carries more tonnage—reducing traffic congestion on the rails and speeding up release of cars for return loads.

All this has been proved by 16 years of General Motors Diesel performance in main line service. So urgent is the demand for these modern locomotives, we are now building General Motors Diesels as rapidly as our facilities and materials permit—a program that assures American railroads a power task-force without equal for the rapid transportation of food, fuel and munitions.



ELECTRO-MOTIVE DIVISION

GENERAL MOTORS • LA GRANGE, ILLINOIS

Home of the Diesel Locomotive

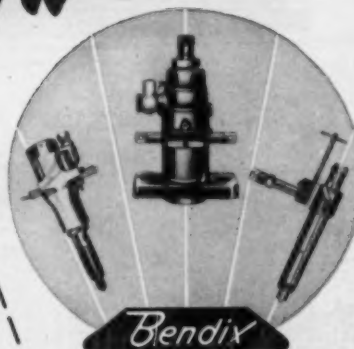
In Canada: GENERAL MOTORS DIESEL, LTD., LONDON, ONT.

TEAM MATES



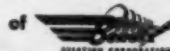
P&H DIESEL DIVISION
HARNISCHFEGER

Two great names, Harnischfeger and Bendix, join in the creation of a line of Diesel engines in which, for the first time, all major castings are of light-weight alloys. The result—less weight per horsepower and rugged design for the toughest jobs. More and more diesel manufacturers are looking to Bendix for the best solution to their fuel injection problems. For Bendix has the engineering know how and the manufacturing experience that assures dependable performance and low operating costs on all types of diesel operations. That's why it pays to specify Bendix for the finest in fuel injection equipment.



FOR PEAK
PERFORMANCE
AND LOW
MAINTENANCE

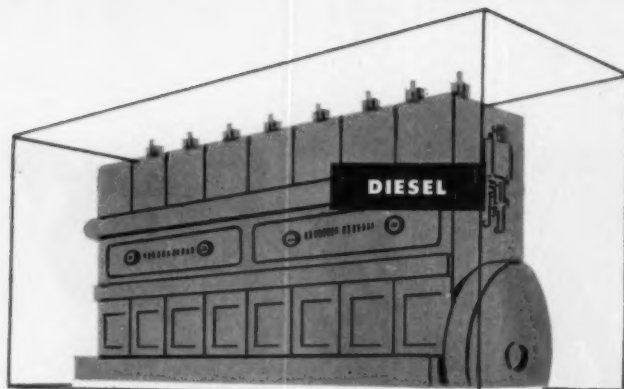
SCINTILLA MAGNETO DIVISION



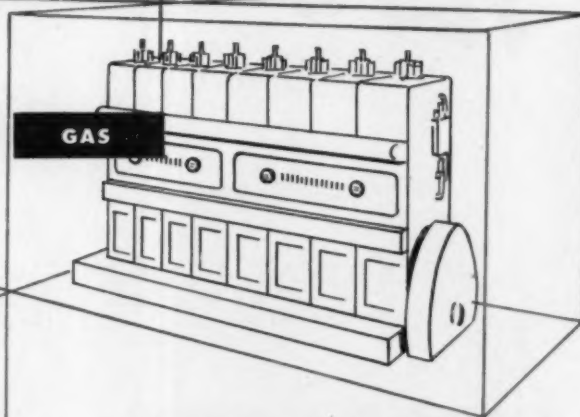
SIDNEY, NEW YORK

Export Sales: Bendix International Division, 72 Fifth Avenue,
New York 11, N. Y.

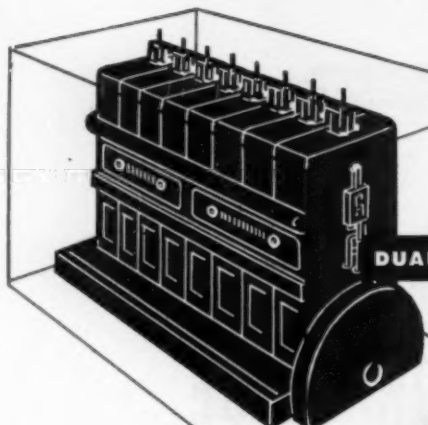
Western Market Office: 552 Market Street, San Francisco 4, California



DIESEL



GAS



DUAL FUEL

WOODWARD

GOVERNORS FOR ALL INTERNAL
COMBUSTION ENGINES



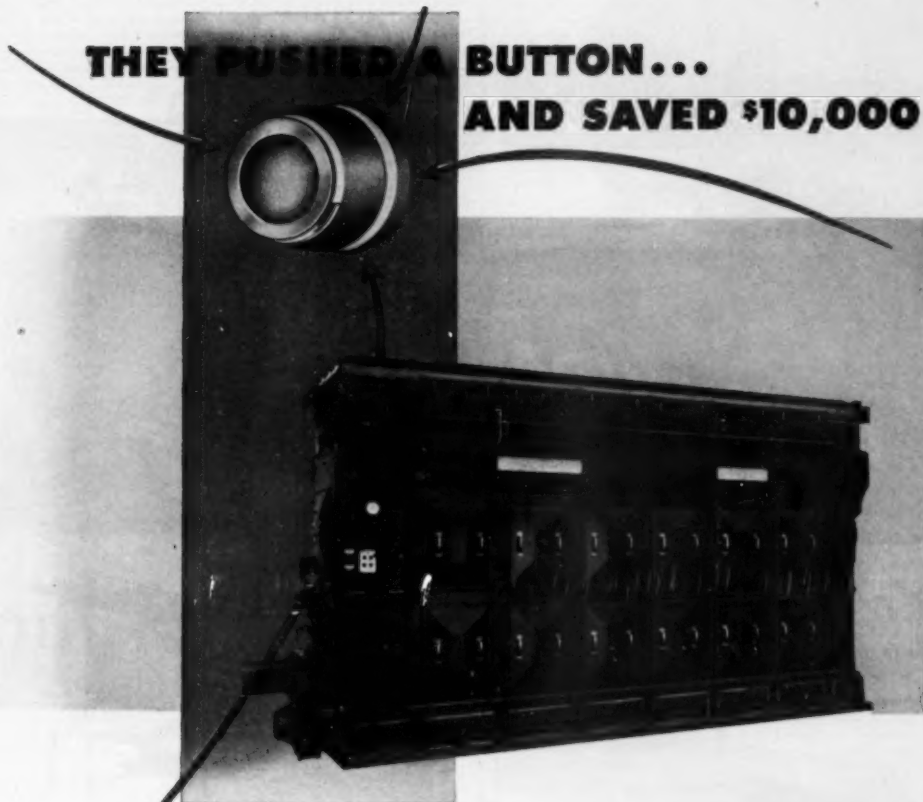
WOODWARD GOVERNOR COMPANY

ROCKFORD, ILLINOIS

World's oldest and largest exclusive manufacturer of
hydraulic governors for prime movers

DIESEL PROGRESS • May, 1951

THEY PUSHED A BUTTON... AND SAVED \$10,000



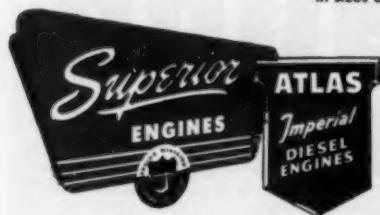
In only 6 months, too!

The owners of this Superior Dual-Fuel Engine can switch from oil to gas or back to oil, depending on which fuel is available or more economical. That's how they rang up a \$10,000 saving in fuel bills in only 6 months of operation.

Owners of these engines can run them on diesel oil, natural gas or waste gas. A push of a button promptly switches the engine from one fuel to the other.

Maintenance costs stay low on Superior and Atlas engines, whatever the fuel. Extra precision, conservative ratings, extra strength and the dependable, economical 4-cycle principle combine to make a Superior or an Atlas Engine your best buy over the years. Continent-wide parts and service facilities assure you of dependable service from your engines. A combined 100 years of Superior-Atlas engineering and engine-building are your assurance of the best design and construction.

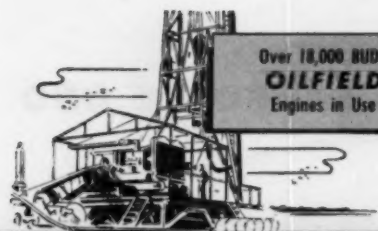
Write for bulletins describing Superior and Atlas engines to meet your requirements, in sizes up to 1500 horsepower.



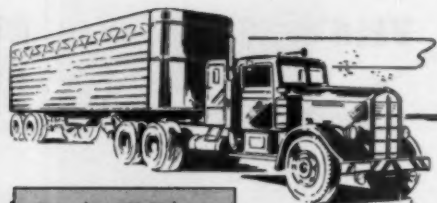
THE NATIONAL SUPPLY COMPANY
ENGINE DIVISION

Plant and General Sales Office: Springfield, Ohio

**DIESEL ENGINES... NATURAL GAS ENGINES...
DUAL FUEL ENGINES**



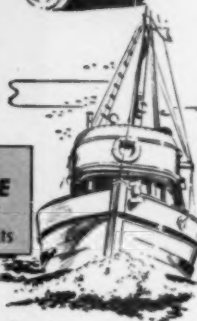
Over 18,000 BUDA
OILFIELD
Engines in Use



More than 300 Highway
TRUCKING Fleets
are using BUDA Diesels

WHO USES BUDA DIESELS?

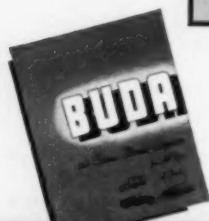
Nearly 2000
BUDA MARINE
Diesels are Powering
Fish, Work and Tow Boats



Approximately 1800
LOGGING and
SAWMILL Operators
rely on BUDA Power



93 Manufacturers of
CONSTRUCTION
and Haulage Equipment
offer BUDA Power



Get this New
Bulletin on BUDA
DIESELS today!

The wide acceptance of Buda Diesels in every industry where dependable power is a vital requirement means just one thing . . . If you have an application for power and want maximum performance at lowest all around cost, it will pay you to investigate the definite advantages of Buda Diesels.

Any of the hundred-odd Buda Dealers or Service Stations located from coast to coast can give you complete details. Write for the new general catalog on Buda Diesels. The Buda Company, Harvey, Illinois.

80-1

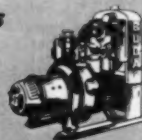
**A Power-Full and Dependable
Name in Engines**



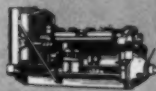
POWER UNITS



AUTOMOTIVE DIESELS



GENERATOR SETS

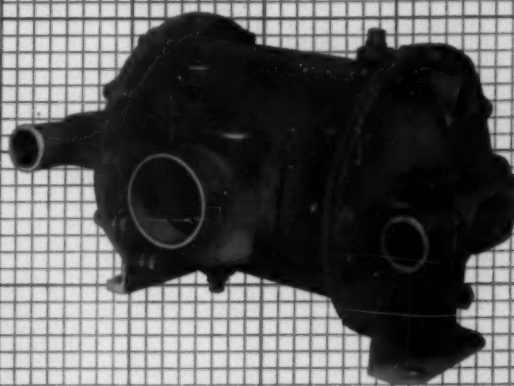
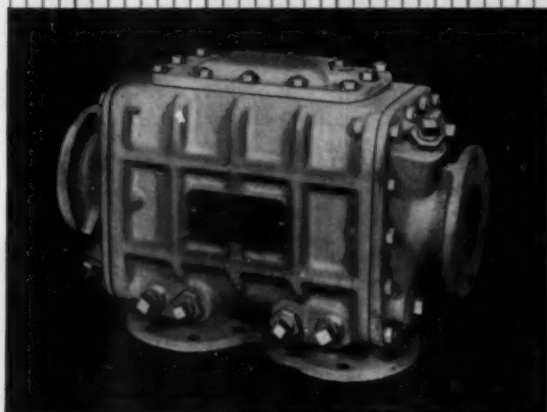


INDUSTRIAL ENGINES



MARINE DIESELS

BUDA



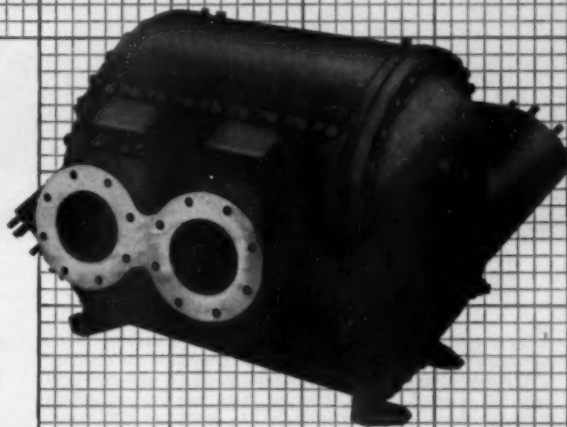
**HARRISON
HEAT EXCHANGERS**

outstanding performers

Developed by a design and engineering staff with wide experience in the field ... built by one of the largest producers of heat-transfer equipment in the country ... Harrison heat exchangers have long been first choice with leading manufacturers of Diesel equipment.

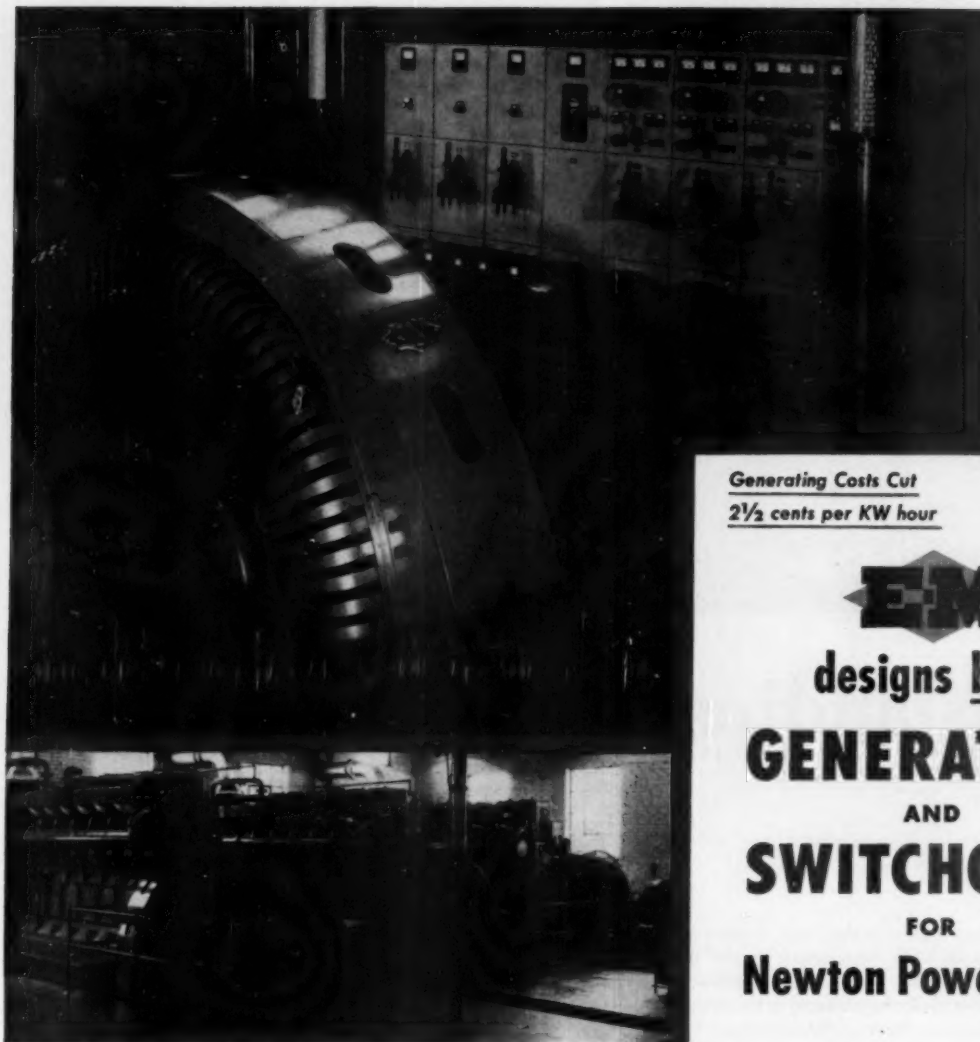
Manufacturers know that there is no compromise with quality at Harrison. Every Harrison installation is carefully engineered, thoroughly tested and skillfully produced. In addition, a capable field service organization helps our customers to get the most out of their installations.

Whatever your needs in heat exchangers, check first with Harrison. Our facilities are always available to our customers.



**HARRISON RADIATOR DIVISION
GENERAL MOTORS CORPORATION
LOCKPORT, NEW YORK**

HARRISON



In the foreground is one of three 560 KW, leading-power-factor, E-M Generators in the new municipal power plant at Newton, Illinois. Coordinated E-M Switchgear is in back. Completely integrated modern design of diesel-electric plant has slashed costs per KW hour to one cent . . . less than one third of former cost.

Generating Costs Cut
 $2\frac{1}{2}$ cents per KW hour

E-M
designs both
GENERATORS
AND
SWITCHGEAR
FOR
Newton Power Plant

E-M Generators and Switchgear direct-connected to super-charged diesels in operation at Newton. Result is economical, regulated electric service to the people of Newton.

ORDINARY citizens are learning about generating plant efficiency at Newton, Illinois. In 1950 they saw the opening of the new Diesel-Electric power plant which replaced a 56 year old original plant. This new plant has cut generating costs for them by approximately $2\frac{1}{2}$ cents per KW hour!

You may be interested in knowing that a substantial part of this important municipal saving is coming from E-M "coordinated design". . . Generators and Switchgear, designed to match each other as combined and integrated units of the new plant. At Newton, the E-M switchboard is engineered for those particular generators. No separately manufactured generator and switchgear can match operating characteristics so closely. Every power plant customer gets better

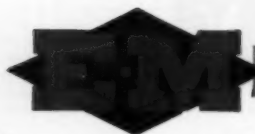
service, fewer breakdowns, safer, more efficient operation . . . and most important to any city whose old plant was losing money—greater savings.

Your future with E-M equipment is bright, too. The three E-M 560 KW leading-power-factor Generators at Newton are constructed for lifetime operation. E-M Generator frames are welded, rolled steel. Coils are insulated for high dielectric strength. The coordinated 8 panel switchboard is easily adaptable to future expansion.

A community or institution takes a big first step toward power plant economy by specifying E-M "coordinated design" for its generators and switchgear. Write for our Bulletin No. 196 or talk to your nearest E-M field engineer.

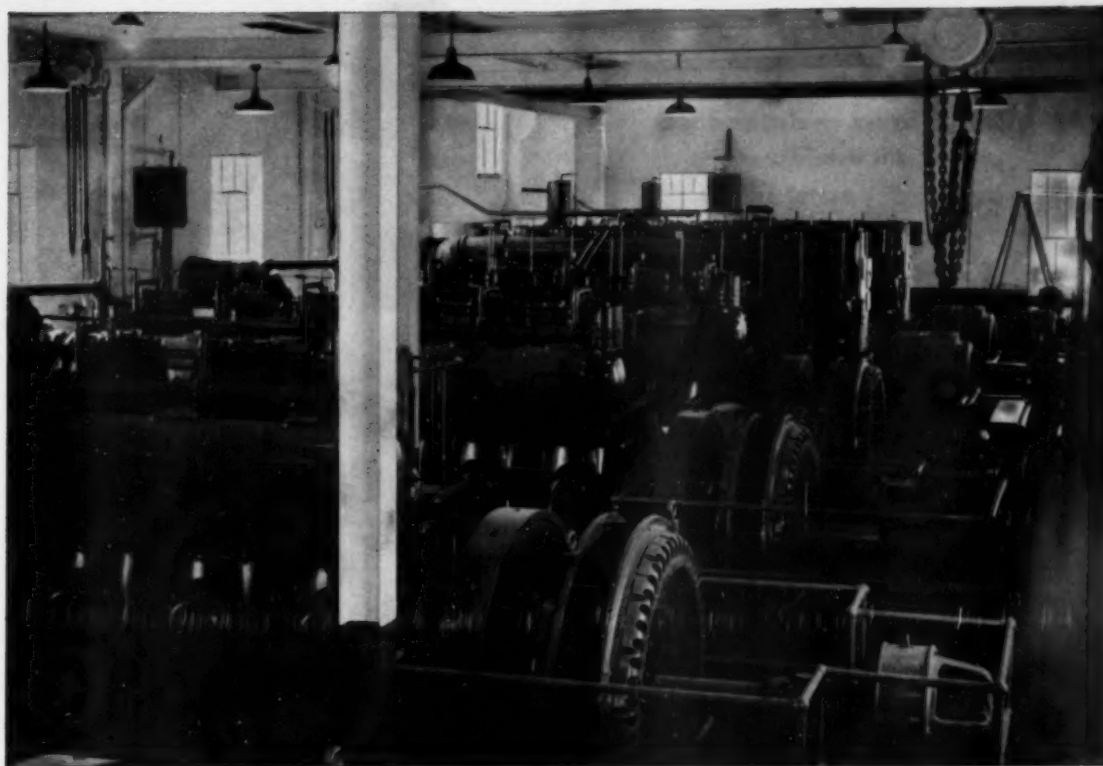
ELECTRIC MACHINERY MFG. COMPANY

1331 TYLER ST. N.E. • MINNEAPOLIS 13, MINNESOTA



SPECIALISTS IN GENERATOR AND SWITCHGEAR ENGINEERING

2200-TPA-2099



Port carbon, bearing failures, and ring sticking cut to a minimum with...

● Stuck rings plagued the Glidden (Iowa) Rural Electrical Co-operative. Overhauls for the plant's seven diesel engines were necessary every 3,000 to 4,000 hours. Moreover, port carbon had to be removed every 300 hours from some engines. Bearing failures added to the troubles.

But that was all changed, in 1947, when a switch was made to STANDARD HD Diesel Oil.

Ring sticking troubles have been eliminated. The first diesel to use STANDARD HD has now operated 15,000 hours without overhaul and shows no sign of requiring one. Carbon formation has been reduced to the point where it is only necessary to clean ports every 600 hours instead of every 300 hours. Bearing maintenance has ceased to be a problem.

The experience of this diesel operator indicates how

STANDARD HD
INDIA, INDIANA
Diesel Oil

STANDARD HD Diesel Oil will help you eliminate costly maintenance and operating problems. A Standard Oil lubrication specialist can show you many plants where STANDARD HD gives this cost-reducing performance.

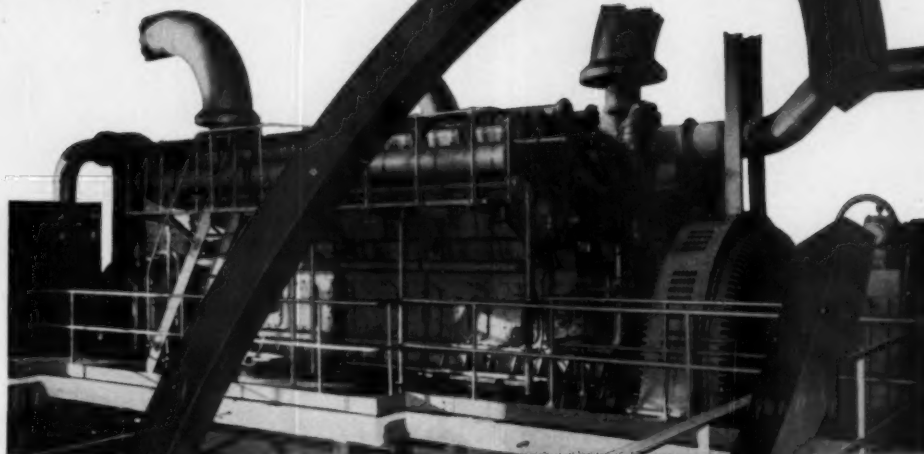
• • •

Call the nearest Standard Oil Company (Indiana) office, or write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the services of a lubrication specialist.

STANDARD OIL COMPANY (INDIANA)



**KOPPERS Porous Chrome
Rings keep maintenance
costs to a minimum
in diesel power plant**



Koppers K-Spun Piston Rings, produced by centrifugal casting process, are 100% stronger . . . four times more resistant to combustion shock than ordinary rings! They will not break in installation or for the life of the engine.

Koppers Porous Chrome* Rings have a porous chrome surface that holds and distributes oil during break-in, quickly wears down to perfectly seated solid chrome that prevents grit and other particles from embedding in the ring surface where they can scratch cylinder walls. Porous Chrome Rings last up to four times as long as other rings, reduce cylinder wear 50% or more.

That's why engineers everywhere are reporting amazing savings in equipment and maintenance costs through the use of Koppers Rings. Remember . . . we make rings for any equipment that uses piston rings.

BYAN DER HORST PROCESS

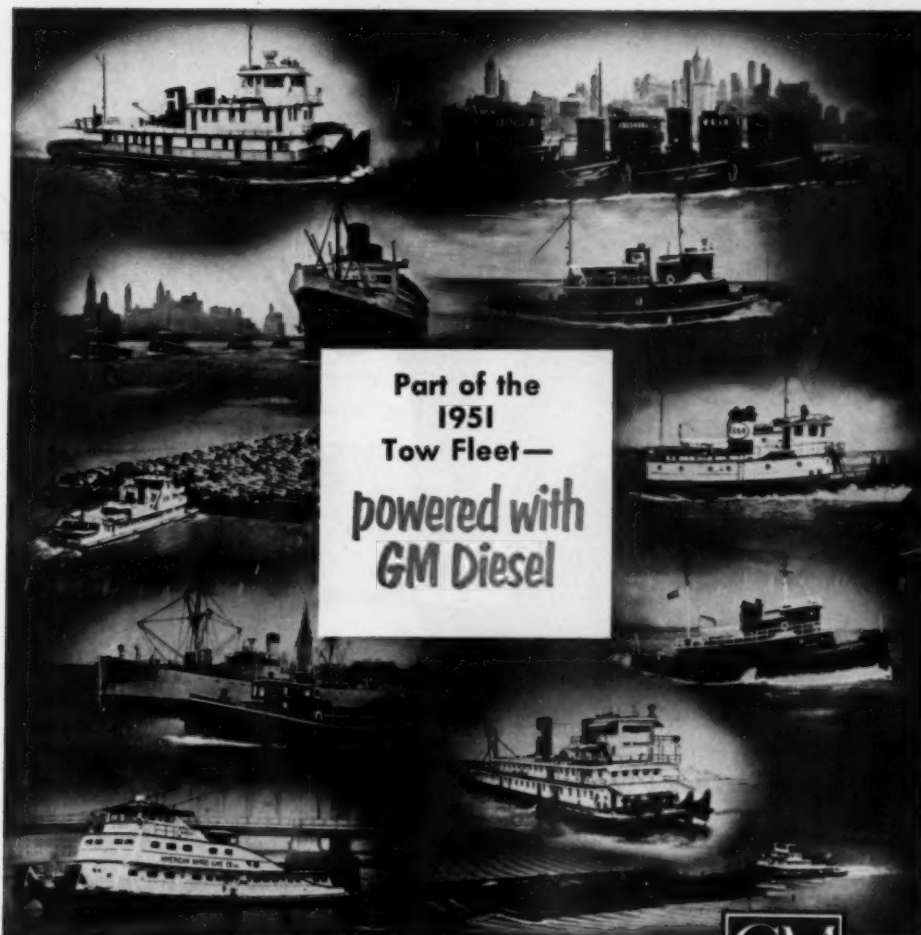
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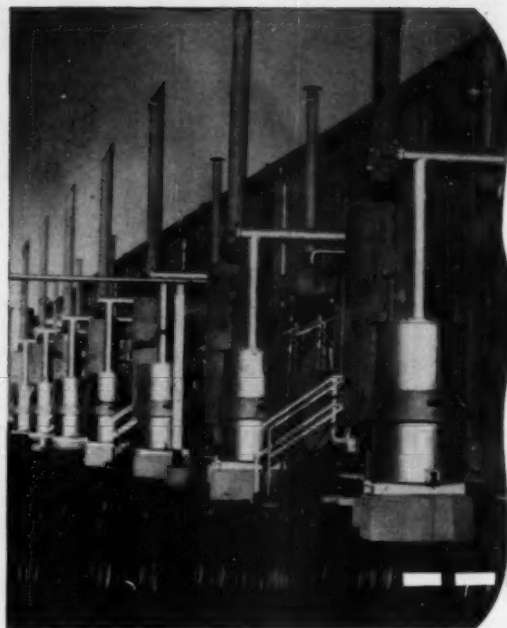
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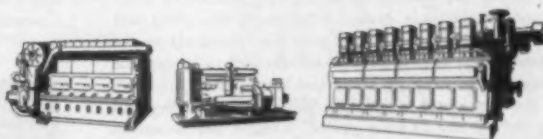


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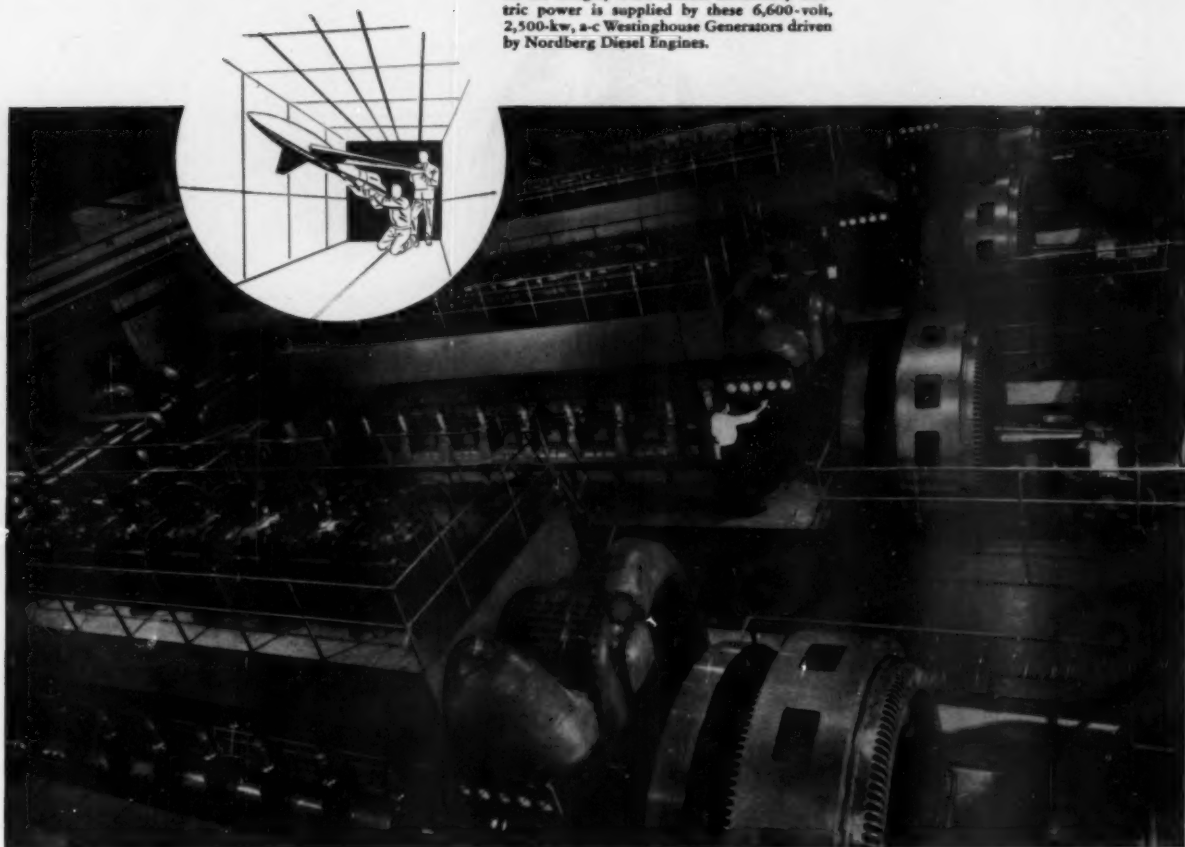
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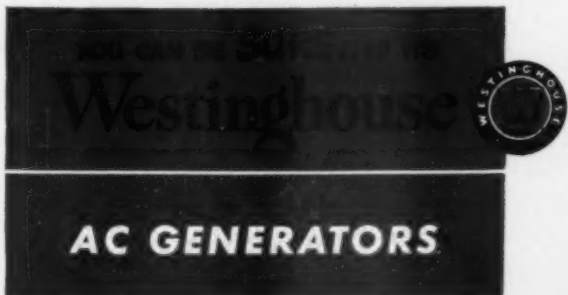
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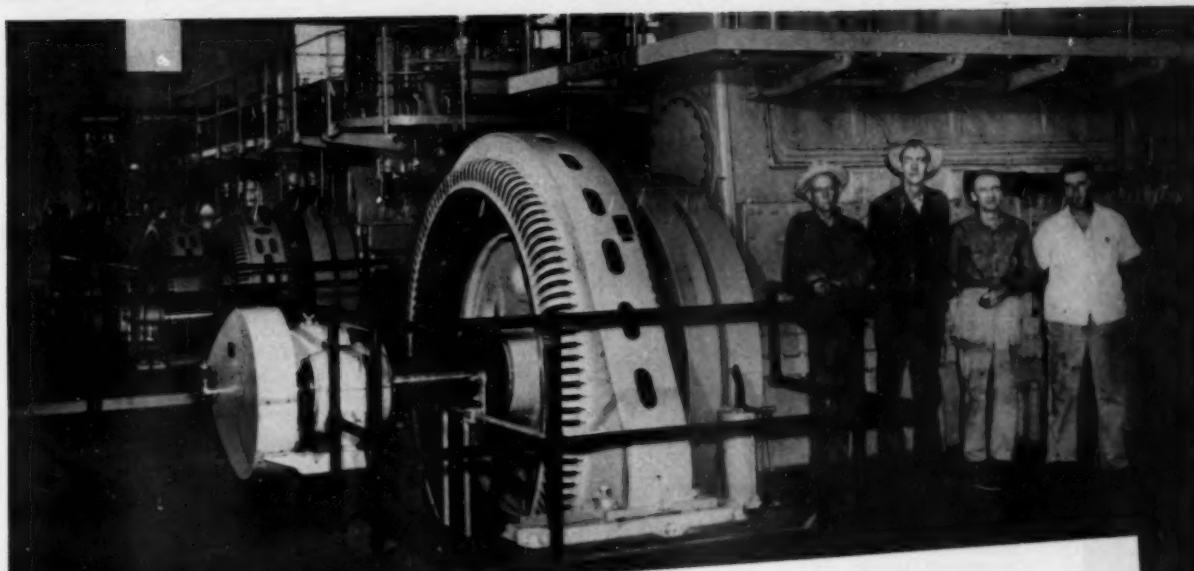
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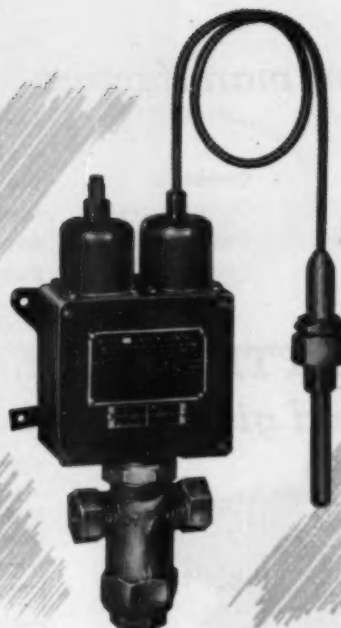
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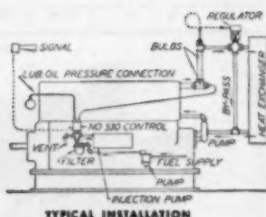
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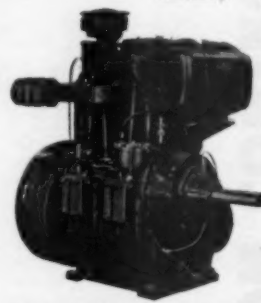
Type	HP Cont.	RPM	BORE In.	STROKE In.	LENGTH In.	WIDTH In.	HEIGHT* In.	WEIGHT Lbs.
AV1	3/4	1000-1800	3.15	4.33	29.75	20.375	36.625	406
AV2	6/12	1000-1800	3.15	4.33	36.5	20.435	36.625	598
B2T	12/18	1000-1500	4.33	4.33	33	24	41.375	1196
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B4T	24/36	1000-1500	4.33	4.33	43.75	24	41.35	1737

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MODEL AVA2—4-cycle, 10.5 hp, 2-cylinder 1800 rpm, vertical, air-cooled industrial diesel engine.



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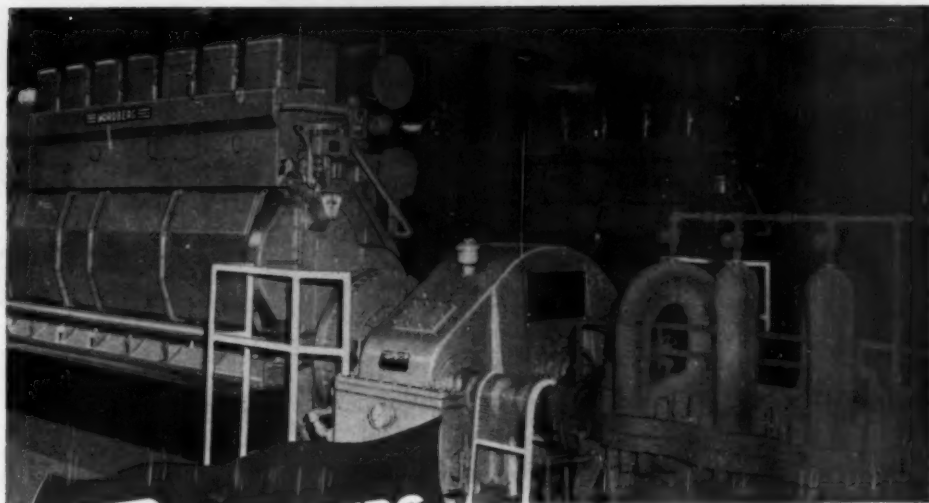
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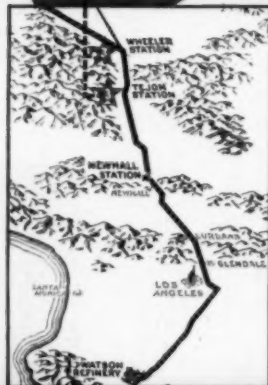
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O151



BOEING'S MIDGET GAS TURBINE

By CHARLES F. A. MANN

FOR the past ten years the diesel engine industry, following the inevitable course of all enterprise that evolves from research, has been asking itself: "What comes after we perfect to the outer limits, the diesel engine?" For the past same ten years, motive power users who have had problems the diesel could not solve, have not only been asking themselves "What comes after the gasoline engine is perfected?" . . . but they have boldly stepped across the limit line and into the field of turbines and jet-type propulsion. This is the field that lies beyond the reciprocating engine, formerly a monopoly of the steam turbine.

As the World's No. 1 builder, and almost exclusively devoted to that field alone, of the large-type aircraft, Boeing Airplane Company of Seattle, found themselves up a stump in 1917 in the course of studying ultra-high power engines for both aircraft and all types of rockets. The limits of what could be done with piston engines driving single or multiple propellers apparently had been reached. The shelves of the world's reference libraries on turbine and jet type power, other than conventional steam, were almost bare. As the size and power of aircraft had gone almost beyond the range of railway cars or boats, and they had, in order to test how far into the unexplored limits of speed they could go, reached the sonic and supersonic zone, and commercial flying had risen to 3 miles above the earth where the air is thin and cold, Boeing felt that in order to maintain its lead in the inventing and perfecting of all types of craft that rose in the air, it would have to tackle the propulsion problem from the grass roots.

World War II had taught four nations the rudiments of giant rocket flying and fighter planes that could fly faster than 400 miles an hour. From this dazzling field, therefore, it would logically follow that someday rockets, guided by the newer electronic controls, might replace space ships that needed men to run them. The key was to find many answers to power—both for the bigger and faster airplanes and the bigger and more ultra long-range rockets. What Boeing's shrewd research staff did was to start out to design the simplest gas turbine engine that could be conceived, with the smallest space and weight per horsepower of output, and bring down the fuel consumption to

below that of gasoline or diesel. At first, it was looking for a midget, powerful jet engine to tack on the tail of rockets or give huge, heavily loaded planes an extra boost at takeoff. What happened afterwards was almost an accident. Boeing actually came up with the world's first midget gas turbine, small and powerful enough to instantly find a dozen commercial uses in fields wide open to something else beside reciprocating engines.

Egged on by the U. S. Air Force and the U. S. Navy, Boeing has evolved a pair of little turbines that apparently are out to upset the world power industry. The Navy already sees many uses for the combined jet engine and gas turbine shaft engine, including use as a prime mover to power small, special Navy craft. By the time this article is published, the Navy will have probably ordered a few from Boeing to put in their new Hush-Hush boats. The Air Forces see a powerful jet engine for many types of rockets, or small aircraft, and, with the gas turbine added on behind, a possible new, compact, light-weight source of power for propeller driven small aircraft, with extra push from the exhaust jet stream, and certainly reduced fuel consumption from the aircraft's own stream of fresh air pushing at the front of the engine to relieve the load on the compressor turbine!

Briefly, the Boeing turbojet is a powerful midget-sized jet engine, consisting of a single-stage centrifugal compressor, two combustion chambers, and a single stage axial flow gas turbine with a rotor disk 7.28 inches in diameter. The entire unit is 22 inches in diameter, 29 inches long and weighs only 111 lbs. Its takeoff maximum thrust, with the

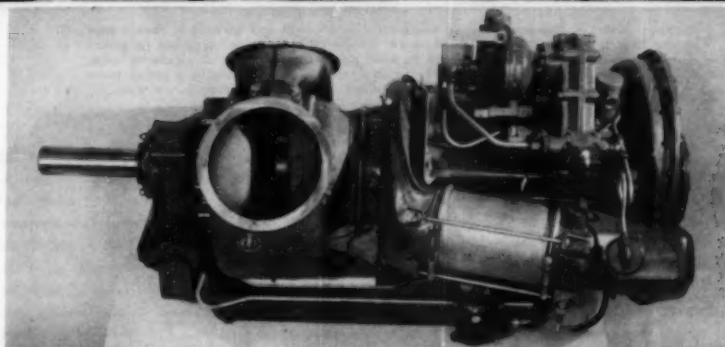
shaft spinning at 38,000 rpm (at sea level) is 210 lbs. Its continuous rating is 180 lb. thrust at 36,000 rpm. The turbine rotor is of alloy steel with 64 welded solid metal blades. Gas temperatures ahead of the turbine are 1500 F. and about 1250 F. at the exhaust or jet opening aft. Fuel, lube, electric starting and twin ignition plugs for the burners are all mounted on the housing over the shaft connecting the compressor and power turbines, below the twin burner tubes. Fuel consumption is 1.22 lbs. per lb. thrust, per hour. (NOTE: In discussing Jet propulsion, the term "Horsepower" gives way to "Pounds Thrust").

There you have the simple turbojet in miniature that is literally the front half of the Boeing gas turbine engine! That's absolutely all there is to it. Following the ancient laws of thermodynamics, the compressed air, leaving the front-end compressor turbine at about 40 lbs. per square inch, is fed to twin tubes. These tubes, crossing to the rear of the unit, have enclosed two perforated alloy steel "can-type" burners. A fuel injection nozzle, regulated by the simple governor, feeds diesel, kerosene, boiler oil, bottled gas or gasoline into the center of the perforated "can", where it burns, after vaporizing at 400 lbs. per square inch pressure, at a temperature of around 3500 degree F. Only one quarter of the compressed air fed into the twin burners is used for combustion. The rest of the air stream is quickly mixed with the fierce, white-hot burned gases, diluting and expanding, so that one continuous blast of relatively "cool" air at about 1500 deg. F. strikes the turbine blades. It is the expansion of this heated volume of air to many times that of the volume entering the com-



Cutaway model of Boeing Airplane Company's light-weight gas turbine is shown here at the Boeing Seattle plant. The 20-pound 160 to 200-hp. engine compares in power output to diesel engines weighing 2,000 to 3,000 pounds. Still in the development stage, the engine has been predicted by Boeing to have ultimate application as a power plant for small boats, trucks, earth-moving machinery, and for stationary power uses.

Installation of the Boeing midjet gas turbine in a Navy test boat at Seattle.



pressor side, that gives the power. Placed on the wing of an airplane, the exhaust, or jet, would propel the plane forward, exactly like a blowtorch gone wild! Less than 90 btu per minute of heat is wasted or absorbed into the lube oil stream! The bearings are positioned to reduce head absorption from heated turbine.

And now . . . If you have carefully read the description of the 500 Boeing turbojet, you are ready for the high school boy's denouement when he thinks of the gas turbine as a complex machine! Take the 500 turbojet and mount it on the front end of a rigid cast-alloy frame. Increase the length of this frame from 29 inches to 42 inches — a mere 13 inches if you please. Raise the weight from 111 lbs. to a flat 200 lbs. by adding a second little turbine, enclosed in an alloy casing to resist the heat, connected to which is a planetary-type reduction gear having a ratio of 8:56 to 1, with a conventional automobile or truck diesel drive shaft extending from the rear—just add this 13 inch "extra" . . . and you have the Boeing 502 gas turbine engine! Inevitably, all great things are simple. So it is with this. Against a weight of 1500 or 2000 lbs. for a gasoline or diesel truck engine of slightly less horsepower, and a mere 12.7 cubic feet of space for the 502 as compared with 66 cubic feet for the comparable diesel or 46 cubic feet for the comparable gas engine, and you see what you have! Separate tables give you the operating characteristics and fuel consumption, which, amazingly, drops down to half that (in cost per hp. hr.) with Bunker C fuel oil or natural gas.

With nothing added, the Boeing 502 comes up with what amounts to the world's first gaseous fluid coupling! It is this feature that has the tractor, truck, logging, paving contractor and earth moving industries agog. For, instead of a complex, costly gearbox, with or without an even more complex fluid coupling, here because the power-producing section, by its very nature, must revolve independently and with no fixed shaft connection between it and the power converting section, we have a perfect ultra-simplified fluid drive that instantly solves three fourths of the expense, maintenance and general clumsiness of gear-changing on a heavy-duty truck or other vehicle! The turbine and gearbox, driven by the jet-blast from the front end, are capable of innumerable speed and load variations without harming a single part of the jet engine in any way. Automatically there is provided a perfect method of rapid variations of load and the driving speed of whatever type of vehicle or machine uses the power, in the gap between the compressor turbine and the driven turbine that spins because of the blast from the hot jet-stream!

Installation of the Boeing gas turbine in a standard Kenworth truck. Note safety shield over turbine section.

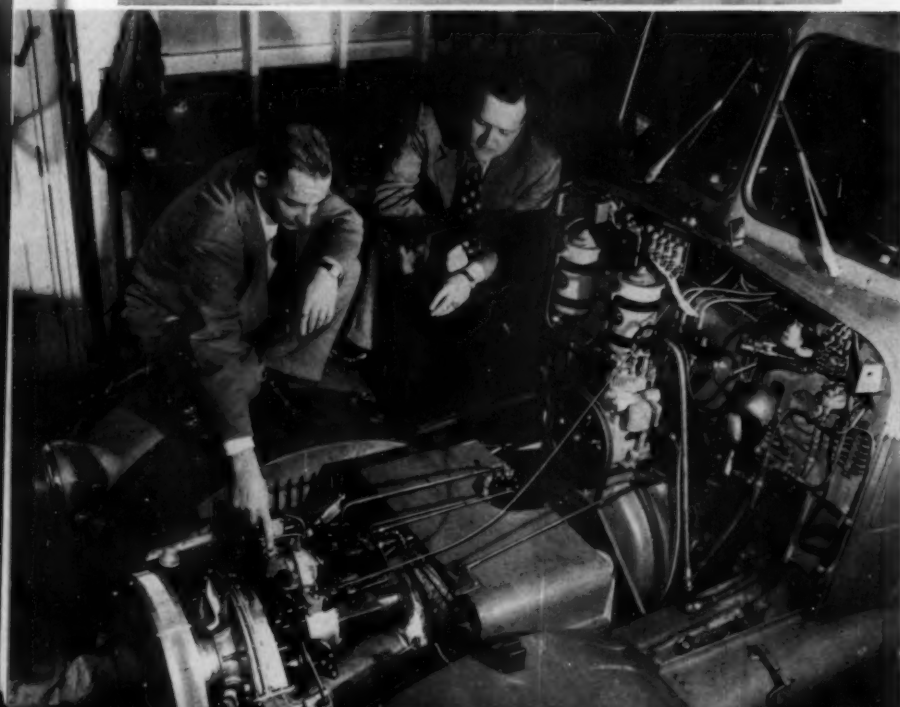
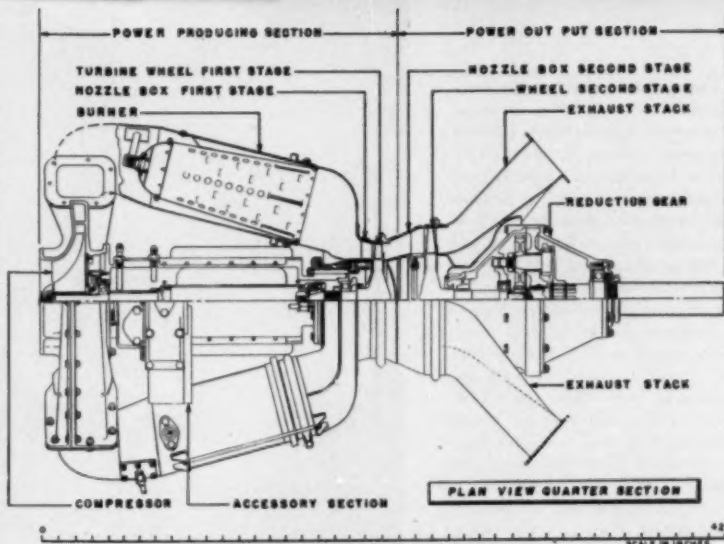


Figure 4. BOEING MODEL 502 GAS TURBINE (Cross Section)



COMPARISON OF HOURLY FUEL COSTS

BOEING MODEL 502-1 GAS TURBINE AND CURRENT TRUCK ENGINES

TYPE OF FUEL	APPROX. COST PER GALLON	APPROX. COST PER POUND	LOWER HEAT VALUE		BTU PER DOLLAR	FUEL COST PER HOUR	
			BTU PER GALLON	BTU PER POUND		BOEING GAS TURBINE (175 HP)	PISTON ENGINE (175 HP)
GASOLINE (REGULAR)	\$0.147	\$0.0247	113,000	19,700	769,230	\$5.14	TYPICAL TRUCK ENGINE \$2.81
KEROSENE	0.146	0.0217	125,000	20,500	857,140	4.56	
DIESEL OIL	0.112	0.0157	130,900	18,360	1,169,430	3.36	DIESEL ENGINE "A" 1.45 DIESEL ENGINE "B" 1.31 HEISELMAN-TYPE ENGINE 1.30
PS-300 FUEL OIL	0.056	0.0089	143,100	17,730	2,569,360	1.53	
BUNKER C	0.038	0.0046	145,400	17,580	3,821,740	1.03	
NATURAL GAS		0.0031		21,420	6,670,000	0.59	

NOTE: THE ABOVE COSTS DO NOT INCLUDE FEDERAL OR STATE TAXES

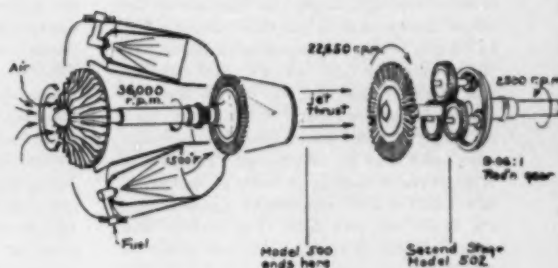
THE BREAK-EVEN POINT OF THE MODEL 502 GAS TURBINE WITH THE DIESEL ENGINE IS 2,890,000 BTU PER DOLLAR.

NOTE THAT THE MODEL 502 GAS TURBINE OPERATES ON NATURAL GAS FOR LESS THAN ONE-HALF THE COST OF A DIESEL ENGINE OPERATING ON DIESEL OIL.

Demonstrating the lightness of Boeing Airplane Company's 175 hp. 290-pound experimental gas turbine engine are four Boeing secretaries. They are (left to right) Ruth Breuninger, Dorothy Kuljis, Mary Lou Sweeney and Ruth Falls. The engine they are lifting is the same as the one installed in Kenworth truck in background. It is the world's first such installation.



MODEL 500 AND MODEL 502 PERFORMANCE CHARACTERISTICS



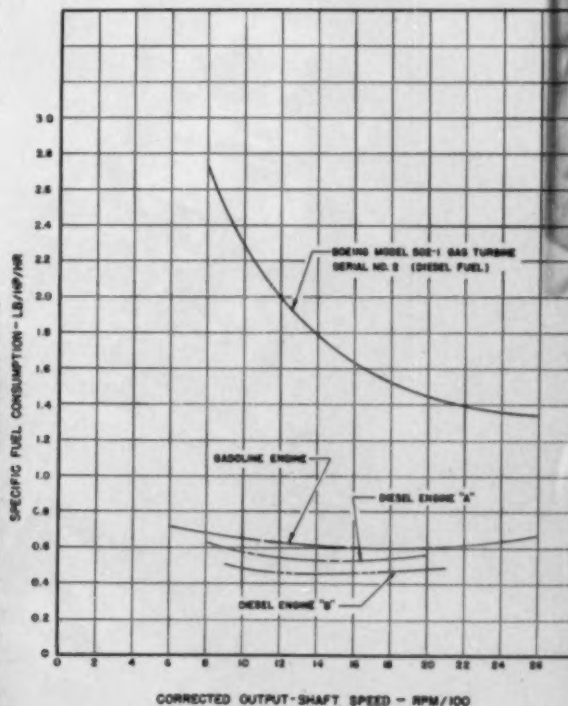
GENERAL CHARACTERISTICS

	500	502
Weight	117 lbs	193 lbs
Power actually produced	.170 lbs thrust	180 H.P.
Probable future developable power by detail refinement	.210 lbs thrust	220 H.P.
Full throttle fuel consumption—now	1.2 lbs/hr thrust	1.25 lbs/hr
Full throttle fuel consumption (probable future)	.9 lbs/hr thrust	.90 lbs/hr

ENGINE PERFORMANCE COMPARISON

BOEING MODEL 502-1 GAS TURBINE AND CURRENT TRUCK ENGINES

SPECIFIC FUEL CONSUMPTION



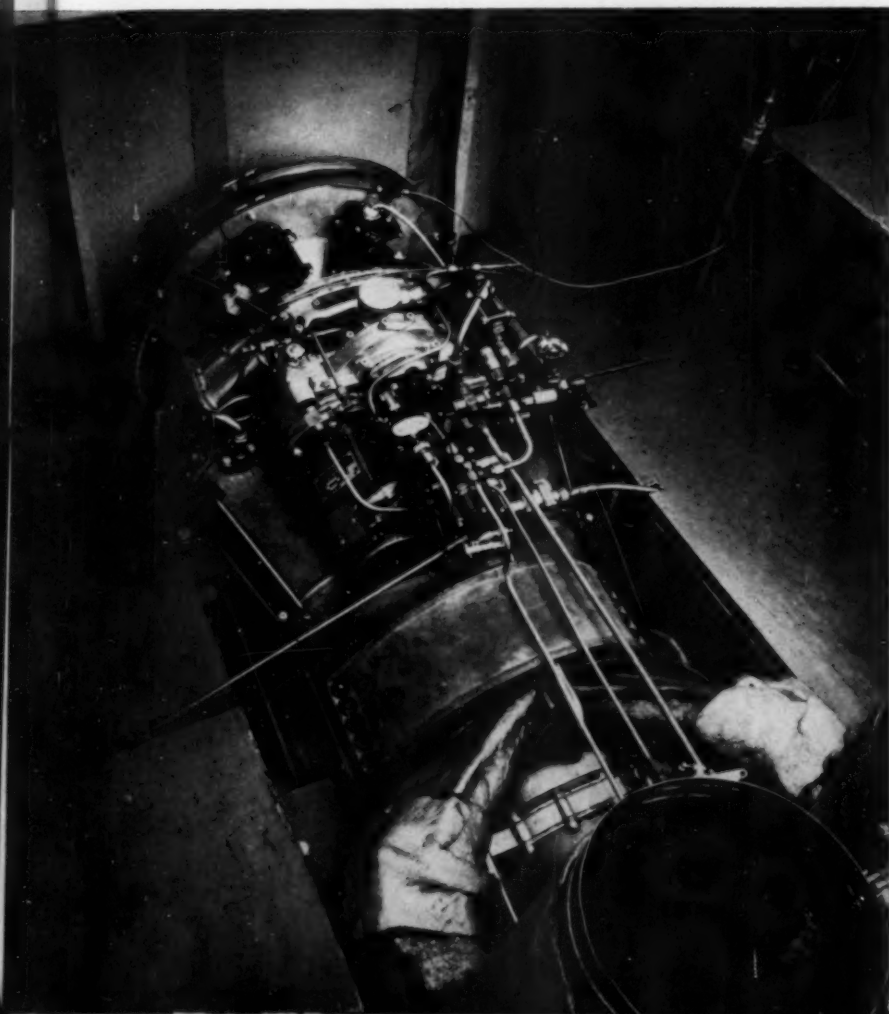
MAY 1951

Thus the Boeing jet engine combines simplicity of design, very light weight, very small size and the torque characteristics of the finest electric motor. In the four years of development, all the original "bugs" have been taken out of it. Fuel consumption, originally close to 2 lbs. per hp. hour, has steadily dropped to about 1.20 lbs. per hp. hour. And as yet no added auxiliary turbines to generate more power from the same hot gas. The question is simply one of equating the added size and weight of a second or third stage turbine, against keeping the weight and space down. The customer must decide whether to sacrifice space and weight for less fuel consumption.

The "500" unit offers an intriguing ultra compact source of portable heat, for up to 3,500,000 btu per hour. The 502 offers a compact power plant with a relatively flat horsepower curve, unique torque characteristics which make it impossible to stall the engine, and with an automatic increase in torque with increase in load. Hooked to another compressor wheel, instead of a gearbox, the 502 offers a terrific source of portable compressed air up to about 30 lbs. pressure in large volume, a field of wide and varied usage not tapped before.

Miscellaneous Features: Because the starting problem involves spinning the gas producer section at speeds up to 15,000 rpm, the 502 requires a 24 volt electric starting motor of about 1½ hp. to get up sufficient speed to bring the fuel, lube and air volume up to proper level to ignite the burners. Also, heavy duty spark plugs ignite the oil vapor, and remain in action until the burners are well started. The fuel pump, of gear type, increases fuel pressure as the speed of the engine raises. The gear type lube oil pump operates at from 50 to 75 lbs. pressure, circulating the oil through a cooler, filter and distributing manifold to feed the bearings, gears etc. A small accessory drive unit, gear driven from the main shaft, operates the pumps, and receives the starting power from the starting motor. A fourth opening for a conventional battery charging generator is provided also in this unit. Development work, is, however, underway to provide a manual crank starter and a magneto, to take care of installations where there is no battery power. Refinement of the 502 gas turbine points to ultimately developing a unit to produce power on 1 lb. of fuel per hp. hr., and, if second-stage turbines are added bring the fuel consumption down to .70 lbs. per hp-hr.

Port side view of Boeing gas turbine installation in Navy test boat



Already an operating life of 2000 hours between major overhauls is within sight. As to be expected, the great volume of air passing through the machine creates a noise problem, as well as the physical problem of handling the exhaust aboard small ships and on vehicles. The experimental Kenworth truck installation, leased by Boeing and now running all kinds of test runs in the Pacific Northwest, has shown where air intake noise is reduced by half with a simple intake silencer. In actual operation, the Kenworth-Boeing experiment shows the gas turbine powered installation to be less noisy than a big diesel truck power plant!

As to be expected, power and efficiency increases as the ambient temperature decreases. The colder the weather the more efficient the plant becomes. Starts, in temperatures down to 70 degrees below zero can be made and full power is attained in less than one minute. The high air-fuel ratio creates exhaust gases that are almost 100% odorless and colorless, with no danger from carbon monoxide.

For the past several months . . . almost a year . . . Boeing has been leasing a 68,000 lb. Kenworth truck-trailer unit for experimenting with the 502 gas turbine. Already it has travelled over 5000 miles, most of it being in the Cascade Mountain area of steep hills, sharp curves etc. The successful outcome of this test resulted in the Navy, January 25, giving Boeing a contract for the 502 turbines



to power minesweeper installations . . . to drive generators in them. The Navy has been experimenting with a similar unit in a 24 ft. Personnel Boat. While the official reports of the Kenworth truck test have not yet been released, enough is known to assert positively that the life expectancy of the 502 gas turbine is now very close to the range of the largest truck diesels and gas engines. Calculations show that the lighter weight of the turbine is worth \$2500 per year to any large truck owner (per vehicle), and the renewed possibilities of improving and shortening the wheelbase of the big transport trucks, with cab-over-engine gas turbine drives is one more step closer. On downhill runs, the braking effect of the turbine drive, with fuel shut off is sufficient to run a loaded truck safely downhill on most major State Highways with no brake application whatever! Using the turbine engine as a downhill brake is much more effective than simply running downhill against compression in a conventional piston engine drive.

Editor's Note: As Voltaire so aptly put it, quite a few years ago: "I disapprove of what you say but will defend to death your right to say it."

The world's first gas-turbine powered truck is shown here during a road service test near Seattle. The ten-ton Kenworth chassis and attached 35-ft. trailer are being propelled by Boeing Airplane Company's new 200-pound turbine engine, which develops 175 hp. The engine has been sponsored by the U. S. Navy Bureau of Ships.

This illustrates the compactness of the Boeing gas turbine as compared with the standard reciprocating engine as installed in the same model of Kenworth truck.



A Dieselized Cement Plant

**Halliburton Portland Cement Company Uses
Fairbanks-Morse Units Totalling 7,200 hp.
at Corpus Christi, Texas, Installation**

By WILLIAM H. GOTTLIEB

FOUR dual-fuel engines are meeting a difficult dual challenge in the big new plant of the Halliburton Portland Cement Company at Corpus Christi, Texas. First, there is the economic challenge: a big modern utility steam plant is located just a few yards away and engine operating costs must compare favorably with the cost of purchased power. Second, there is the operating challenge: The big ball grinding mills and other processing equipment are always a taxing load and sometimes a staggering load, for the power plant. Rounding out their first year of service, the engines have met both these challenges with unqualified success. First, Vice-President Elroy King reports that it has been profitable to operate dual-fuel engines. Second, the plant has not experienced a single shut-down due to engine failure.

All four engines are two-cycle, Model 33FD16 Fairbanks-Morse dual-fuels of 16-in. bore and 20-in. stroke, developing rated horsepower at 300 rpm. Two of the prime movers are 10-cylinder units rated at 2,000 hp. and two are 8-cylinder engines rated at 1,600 hp. The larger engines drive 1,400-kw., 4,160-volt Fairbanks-Morse alternators; the smaller engines turn 1,125-kw. F-M alternators.

The multi-million-dollar Halliburton mill has a capacity of 1,500,000 barrels of Portland cement a year and incorporates many unique design features. Though not the first to make cement from oyster shells, this is the first cement mill to grind oyster shell in closed circuit with rake and bowl-type classifiers. All raw materials—shell, clay, and bauxite and iron ore—are ground separately and stored as slurry in individual tanks to permit maximum flexibility in blending the product. Another unusual feature is the provision of duplicate equipment which not only insures continuity of production but makes it possible to operate two complete circuits independently. Thus, the plant can run at half capacity or produce two different cements simultaneously.

Cement manufacture requires heavy, power-consuming equipment. The two primary grinders are 8x16 ft. Allis-Chalmers ball mills driven by 450-hp. Electric Machinery synchronous motors. A secondary mill for shell grinding takes another 450-hp. motor. G.E. 100-hp. motors turn the two 377-ft. kilns and each kiln has two induced draft fans driven by 100-hp. motors. Clinker is ground into cement in two 7x40-ft. Allis-Chalmers 3-compartment ball mills driven by 700-hp. Electric Machinery synchronous motors. Cement is pumped to storage by two pumps driven by 150-hp. EM motors and the pumps are served by two rotary compressors driven by 200-hp. motors. This ob-

viously is but a fragmentary list of equipment. In all, it takes 5,600 hp. to operate the plant at capacity, a load which can be carried by three engines with one 1,600-hp. unit in reserve.


It is the practice in this plant to run engines at full load. Units in operation must run at an overload before the operator starts up another engine. Even the 5,600-hp. requirement, however, is not the full story on power demand. Pieces of heavy machinery stop and start and the starts take lots of power. For example, the mills that grind clinker into cement each hold about 6,500 lbs. of 3½-in. balls, 14,600 lbs. of 3-in. balls and 14,000 lbs. of 2-in. balls in the first compartment; 44,500 lbs. of 1¼-in. balls in the second compartment; and 61,800 lbs. of ¾-in. Concavex media in the third compartment. There are no clutches and the 700-hp. electric motor is started across the line, pulling an estimated 500% overload. Works Manager A. J. Anderson reports that the big mill is usually started when the engines in operation are already fully loaded, yet they take the sudden surge of demand in stride. This was one of the factors which influenced Halliburton to put in its own power plant, since the power company took a dim view of starting the big motors across the line. Economy was another big factor. Demand charges for purchased power were bound to be high. Initially, it would be necessary to construct a big sub-station. Finally, natural gas is cheap in Texas and dual-fuel engines promised to generate power at competitive costs.

The four-engine plant first went into service in December, 1949, and reached full production in 1950, producing at the rate of 25,000,000 kwh. a year. Operating figures are available for the first six months. In the six-month period from July through December, 1950, the plant generated 12,775,700 kwh. while consuming 139,977 mcf. of natural gas and 94,227 gal. of fuel oil. This represents an average consumption of 10.96 cu. ft. of gas per kwh. Pilot fuel supplied 7% of the btu's. The four units ran a combined total of 13,816 hours out of a possible 17,520. During this time, lubricating oil consumption totaled 5,422 gal., an average of 4,601 hph. per gal. The engines can operate either as full diesels or on natural gas with oil as pilot fuel, and can be switched instantly from one fuel to the other. There have been several occasions when the gas supply failed and the engines automatically switched to fuel oil while running at full load. Gas reaches the plant at 50 to 60 lb. pressure, is regulated to 56 lbs. by an orifice fitting, is metered, and then reduced to 17 lbs. in individual regulators for each engine. Fuel oil flows by gravity from storage to four 600-



This 30-kw. Fairbanks-Morse diesel generating set kept the thickener going in an emergency, preventing possible prolonged shut-down for the plant. It also provides power for lighting and engine auxiliaries.



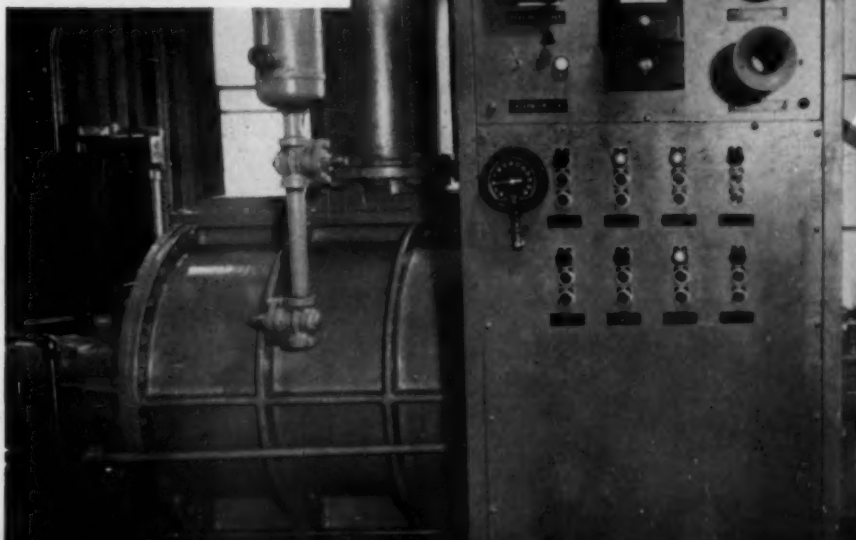

 The new Halliburton mill at Corpus Christi has a capacity of 1,500,000 barrels of Portland cement a year. The company finds it more profitable to generate its own power than to buy from an adjoining public utility steam plant.

gal. day tanks. Picked up by engine-driven supply pumps, the fuel is pumped through duplex filters to the special small-capacity injection pumps that handle the pilot oil.

A straight mineral oil is used to lubricate the engines and cool the pistons. Oil is circulated under pressure by built-in engine-driven pumps to the bearings and pistons and through a shell-and-tube oil cooler. Part of the oil is drawn from the crankcase continuously and put through a Fuller's earth purifier for each engine. Upper cylinders are supplied with lube by force-feed mechanical lubricators which are filled automatically from the crankcase oil supply. Each engine has a motor driven auxiliary lube pump for use in starting and shutting down. Each engine has a separate closed cooling water system with a motor-driven centrifugal pump circulating soft water through the engine jackets and a shell-and-tube exchanger. Jacket make-up water is treated in a zeolite softener. Nueces Bay, which adjoins the plant, provides an abundant supply of salt water for the raw circuit. The salt water is taken from the bay by three vertical turbine pumps, put through the exchangers and discharged to the bay. Jacket temperature is regulated by automatic thermostatic controls which bypass soft water around the exchangers.

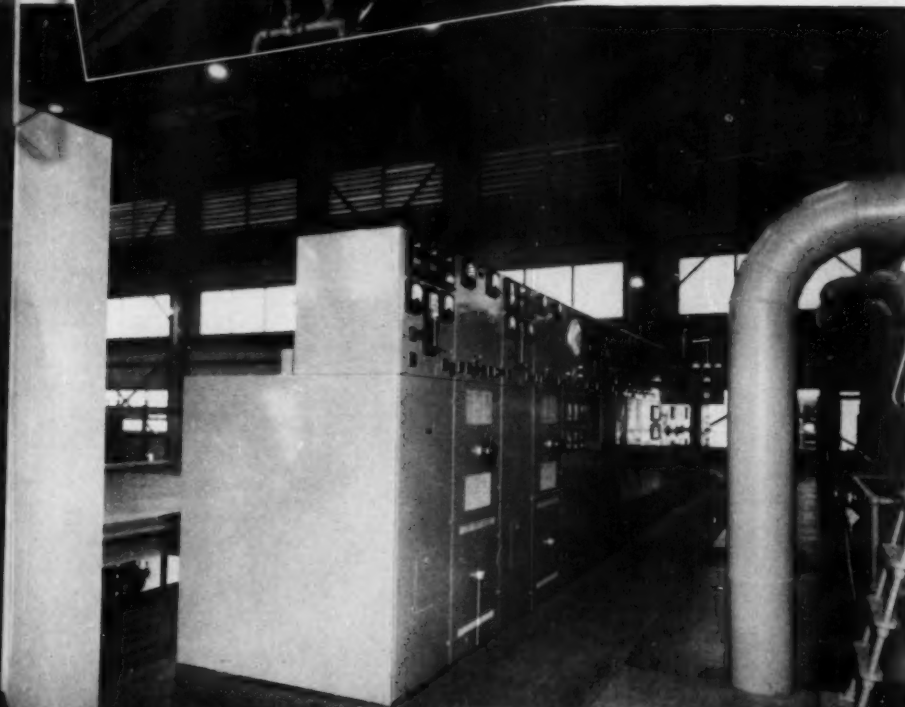
The 1,600-hp. units have built-in scavenging pumps. The 200-hp. engines are supplied with scavenging air by motor-driven rotary positive blowers. Air for each engine is drawn from outside the building through 16-element impingement-type filters in metal air houses. Exhaust gases vent through vertical silencers. Starting air is pro-

A gauge board near each engine holds an Alnor pyrometer, day tank Levelometer, pressure gauges, alarms and switches for engine auxiliaries.



The four Fairbanks-Morse diesels are producing power at the rate of 25 million kw. a year. To date there has never been an engine failure.

Power for the Halliburton mill is supplied by these four Fairbanks-Morse dual-fuel engines. The units at left are rated at 1,600 hp., the engine at right at 2,000 hp.



vided by a pair of vertical motor-driven compressors which keep four bottles at 250 psi. The power plant's main switchboard is of the all-enclosed, dead-front, unit type with electrically-operated switchgear and particularly complete instrumentation. There is also a gauge panel beside each engine with an exhaust pyrometer, day tank level meter, gauges and alarms on lube and water pressure, and switches for engine auxiliaries. One piece of equipment that already has earned many times its price is a 6-cylinder Fairbanks-Morse diesel which turns an Electric Machinery synchronous generator at 1,200 rpm. to develop 30 kw. The most crucial piece of production machinery in the mill is the thickener on which the entire plant depends. The thickener must run constantly and, if power failure caused it to stop, the mill might be shut down for a prolonged period.

To insure an unfailing power supply, plant designers provided three alternate sources: a special line to the nearby utility plant, the mill's own four-engine power plant, and finally the little diesel-generator set. If one source fails, an automatic device switches the thickener motor to the next source, and then, if necessary, to the third.



On one occasion, lightning knocked out the transformers of both the utility and the big dual-fuels and it was the 90-kw. generator that kept the thickener going. This standby service is most important, but the little diesel has other functions. It provides enough power to light the entire mill and operate starting air compressors and other engine auxiliaries when all the big engines are shut down.

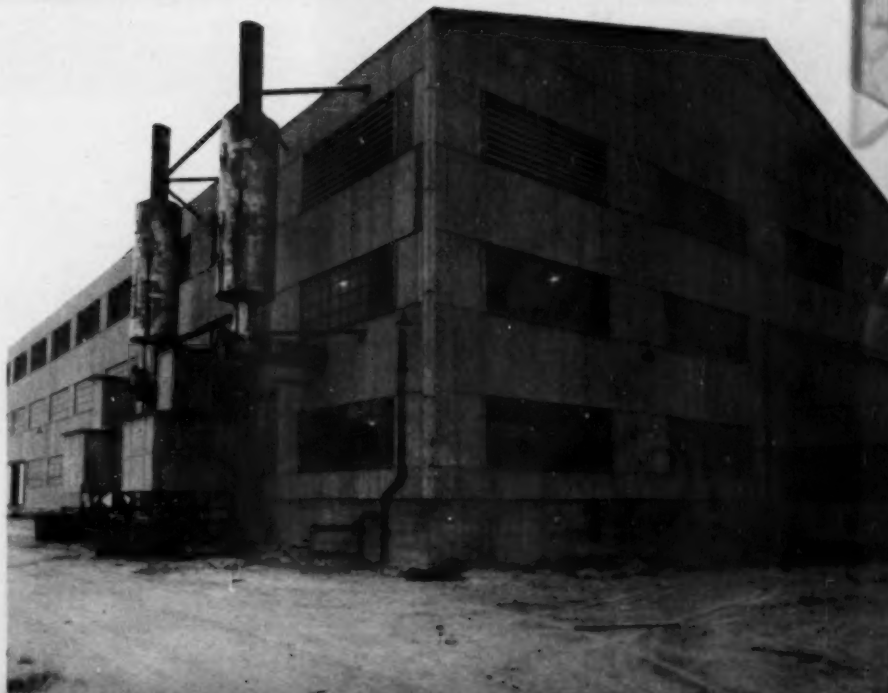
There is evidence throughout the mill of Halliburton's determination to manufacture a fine product with maximum efficiency. In the power plant this is evidenced by the heavy-duty prime movers and their full complement of protective accessory equipment. It is an extremely attractive plant and its appearance reflects the pride of management and operating personnel. The engines are painted gray-green, foundations gray, and floors Spanish tile red. All piping and equipment are painted in accordance with a color code which not only enhances the appearance of the plant but facilitates quick identification and correction of trouble. A preventive maintenance program is designed to keep the engines in peak condition. In the first year, no repairs were necessary.

The management of Halliburton Portland Cement Company is energetic, progressive and thoroughly experienced. Erle P. Halliburton is president; Ellroy King, vice-president, secretary and treasurer; Erle P. Halliburton, Jr., vice-president; A. J. Anderson, works manager; Keith Sandefer, chief engineer; H. R. Gingerich, chief chemist; and Marshall Clements, sales manager; power plant superintendent, Herbert Bolt.

List of Equipment

Engines—Two 2,000-hp. and two 1,600-hp. Fairbanks-Morse.
Standby Diesel—Six-cylinder Fairbanks-Morse
Generators—Two 1,400-kw. and 1,125-kw. Fairbanks-Morse.
Blowers—Roots-Connorsville.
Air Filters—Air-Mare.
Exhaust Silencers—Maxim.
Lube Oil—Gulf Security E.
Lube Purifiers—Honan-Crane.
Oil Coolers—Ross.
Cylinder Lubricators—Manzel.
Auxiliary Lube Pumps—Roper.
Fuel Filters—Nugent.
Gas Regulators—Fisher.
Cooling Water Pumps—Fairbanks-Morse.
Heat Exchangers—Ross.
Water Softener—Fairbanks-Morse.
Exhaust Pyrometers—Alnor.
Levelmeters—Levelometer Corp.
Fuel Oil—Humble Oil Co.
Natural Gas—Houston Natural Gas Co.
Switchboard—I.T.E.
Switchboard Instruments—General Electric Co.
Air Compressors—Gardner-Denver.

Exhaust gases vent through Maxim silencers. The metal air houses hold 16-element Air-Mare air filters for scavenging air.



DIESEL TUG-O-WAR

By JAMES JOSEPH

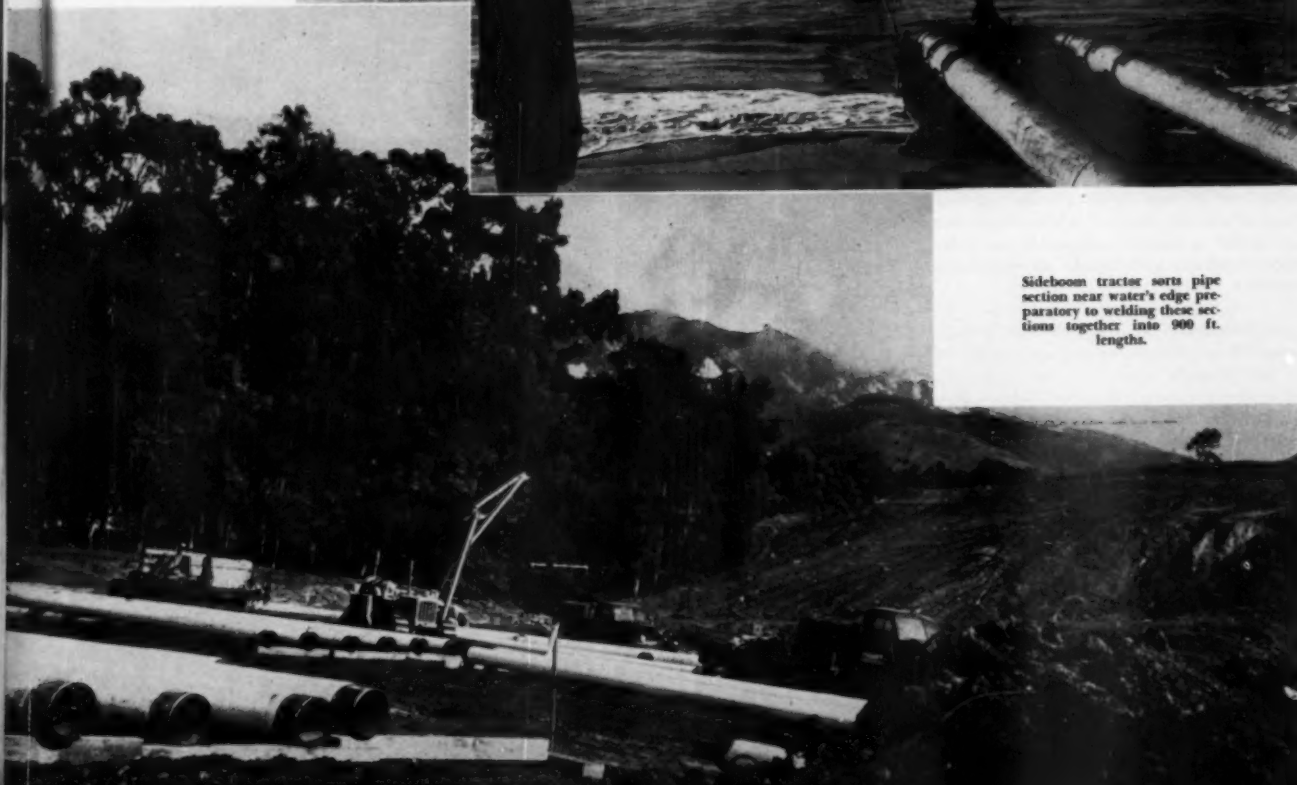
ONE day last December there was a diesel tug-o-war along the sultry Pacific coast near Gaviota, California, when diesels knocked themselves out and successfully pulled 2400 feet of heavy dual submarine oil line into the sea. Off shore stood Smith-Rice Derrick Barges Inc.'s 110 ton capacity diesel-electric barge. Ashore, diesel sidebooms strained and tracked, hoisting the 12 inch diameter oil line into place until it rested on cradles along a specially-built track. Then, while a tug scuttled back and forth between the shore and the barge, the double-drummed winches on the barge took up the slack in 1200 feet of 1¾-inch steel cable. On that initial pull, one of three

915 ft. long track had to be laid over right-of-way donated by diesel. Track was temporary, later removed.

Line grows taut, and a diesel at the end of 1200 feet of 1¾ in. steel cable does the job again.



Sideboom tractor sorts pipe section near water's edge preparatory to welding these sections together into 900 ft. lengths.



900 foot pipe lengths, there were 50 tons fighting the barge's diesel might. As each successive section was added to the line, and it too hauled into the sea, the load doubled, then tripled. On the last pull, with 2700 feet of dual pipe attached, the diesel barge was inching seaward 150 tons of steel at the end of three 1½-inch cables.

Diesels on both ends got the pipelaying job completed during one continuous operation from 7 a.m. until 10 p.m. The job was necessarily continuous—with no stopping—to prevent the shifting currents from sanding over the pipe. When the diesels were done, they laid the third dual line on the west coast and had established another "pick-up" point for tanker loading, this one with a loading capacity of 7500 bbls. an hour.

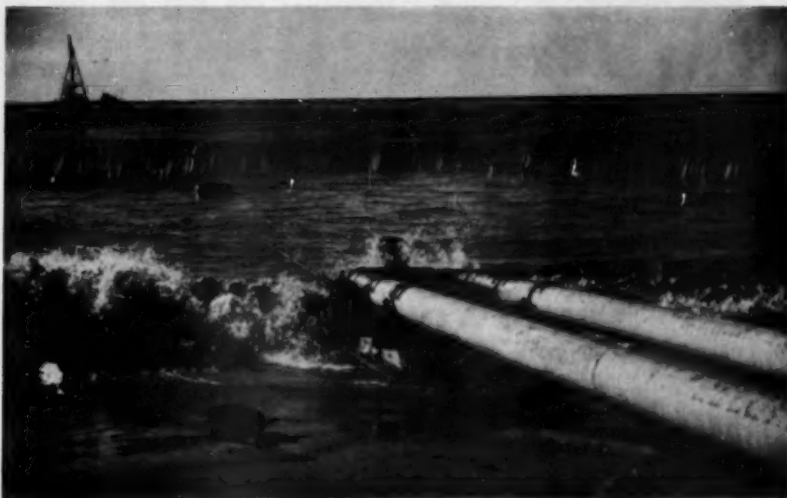
The big diesel electric barge offshore runs its swing hoist and boom by a GMC 100 kw. diesel-electric rig and also by a Caterpillar D-17000. The deck winches—each with double drums—are powered by a 160 hp. Waukesha. Also aboard is a 10 kw. Hercules light plant. The big winches, when in low gear, can handle 235,000 lbs. pulls at a rate of 12 feet a minute using a single line. Which in the barge-derrick construction business is "some pull." In the tanker-loading set-up, ships will lay to off the Gaviota pumping station, pick up the rubber "take-off" hose and fill up. The "take off" line is 10 inch diameter flexible rubber and is attached to the end of the submerged dual steel pipe. The "take-off" line is 120 feet long and is attached to a pick-up buoy—for it's this line which is taken aboard a tanker during loading. Dual lines were necessary because oil from the nearby Zaca field is so heavy that without a circulatory system, it would have been impossible to keep the lines clear. As it is, hot, diluted crude oil will flow through the line from a pumping station about 300 feet inshore. Zaca field oil has a gravity rating of 8.

At the line's terminus, the pipe lies some 55 feet below the water, resting on the ocean bottom. A coral reef about 75 feet offshore protruded 14 feet from the ocean floor and directly in the path of the work. Divers blasted this obstruction away, used 1500 lbs. of tube dynamite in the process, and laid the tube explosives along the reef's edge, held submerged by sand.

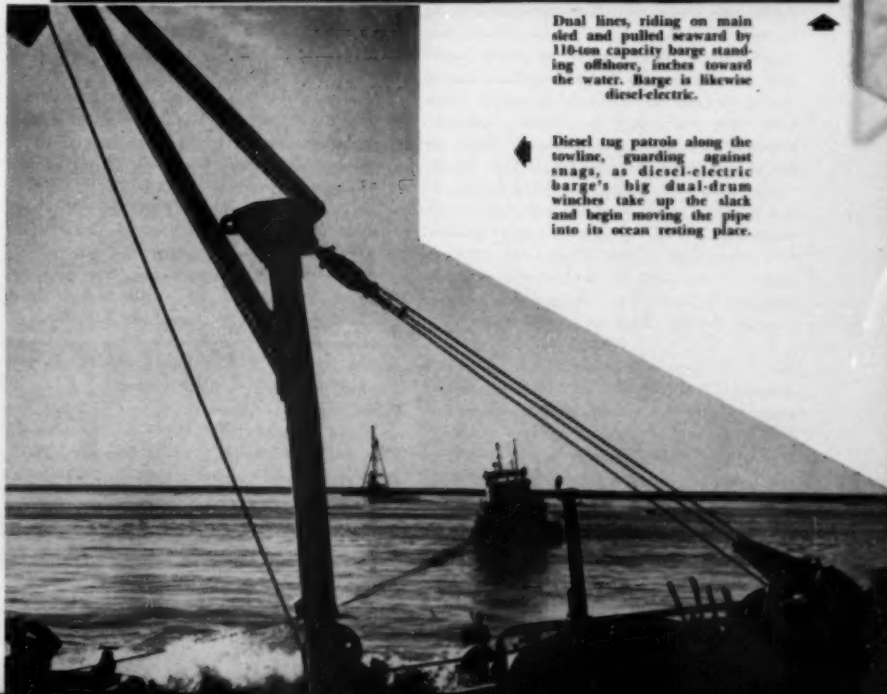
Prior to pipelaying, general contractor Hood Construction Co. built a 915 foot track of standard gauge rails. This was necessary to allow for three "pulls" of 900 feet each. Diesels excavated the track right-of-way, dozered the incline to the water, and helped move up heavy timbers used as ties. The 12 inch diameter pipe came in 40 foot lengths, and these had to be welded into six, 900 feet "pull sections" (dual lines, remember). Sidebooms lifted the 900 foot lengths on to cradles which were spaced along the track to carry the load. Cradles were constructed by nailing two 2 by 12's together, attaching 2-inch by 3-inch angle irons to their undersides to hold the cradle to the rails, and by notching 2 by 6's fastened to the cradle's top-side—fitting the pipe. All-in-all, it was a kind of diesel tug-o-war, but it accomplished the job—pulling 2400 feet of dual pipe into the Pacific in one continuous operation.



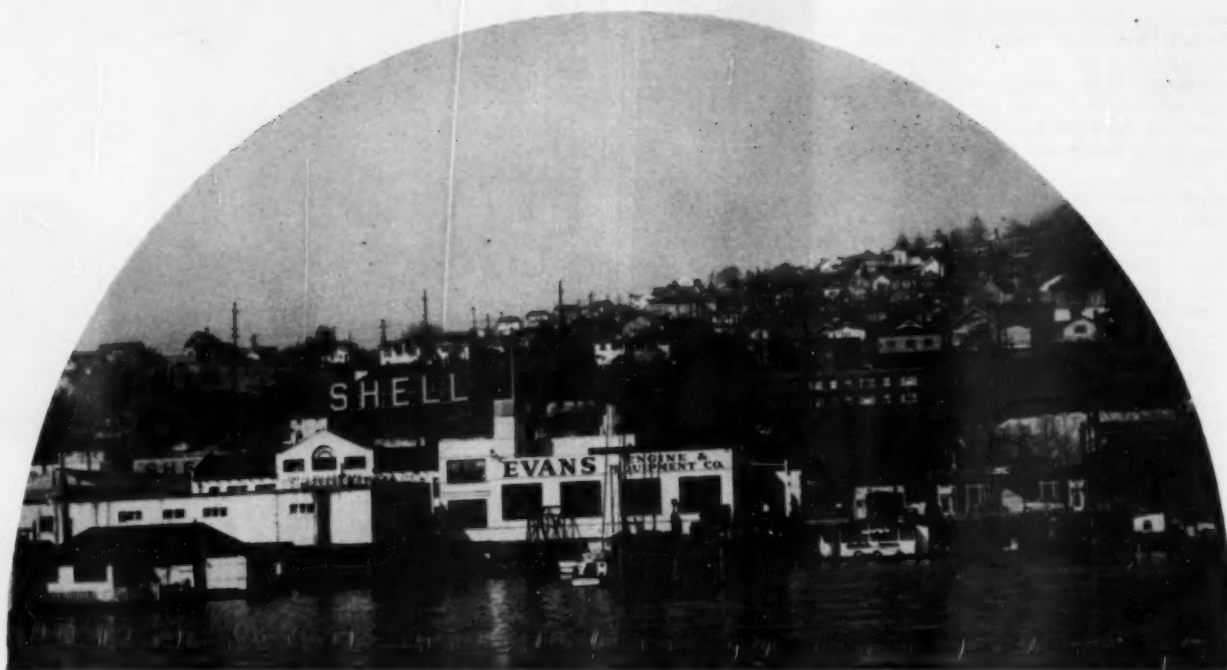
Dozing a right-of-way at water's edge for the rail-track.



Dual lines, riding on main sled and pulled seaward by 110-ton capacity barge standing offshore, inches toward the water. Barge is likewise diesel-electric.



Diesel tug patrols along the towline, guarding against snags, as diesel-electric barge's big dual-drum winches take up the slack and begin moving the pipe into its ocean resting place.



The Evans Engine & Equipment Co. has a waterside location on Lake Union in Seattle and is reached from salt water by canal. The dock is now being extended in order to accommodate a greater number of fishing vessels.

Northwest Yards Launch Fishing Craft

By W. J. GRANBERG

WINTERTIME is boat building time in the Pacific Northwest, with Seattle and Tacoma yards busy on tuna clippers and fishing boats that go down the ways or leave outfitting docks in time for the new season, and on tugs that await spring for their heavy log towing chores on the ocean and Puget Sound. Diesel engines, of course, power most of these craft, both for propulsion and in driving the generators that serve the modern equipment these craft carry. In Tacoma, sometimes known as the capital of the tuna boat industry, the first clipper to have its trial run in 1951 was the *Golden Glow*, while in Seattle the *New Era* was the first halibuter to go down the ways. At an outfitting dock in Seattle the *Hannah-C* was repowered with a new Model 62200 Detroit GMC 110 diesel engine. In the tug field, the *Sunbury* was repowered with a Detroit 110, with the owner ordering a second 110 for a sister tug, the *Hubble-6*.

Built by the Sagstad Shipyards from the firm's own designs, the *New Era* went down the ways on January 25 and was moored at the outfitting dock for finishing touches on installation of the Model 6-71 General Motors diesel engine. Turning at 1800 rpm., the engine will put 400 rpm. on the shaft through a GMC hydraulic reduction gear operating at a ratio of 4.5:1. The propeller is a 50 x 33 Olympic wheel and cruising speed of this combined purse seiner and halibuter is estimated

at 8.5 knots, with a capacity of 63,000 halibut iced down. Fuel consumption is calculated at seven gallons an hour. With mahogany woodwork and trim throughout its interior, including galley and crew's quarters, along with teakwood exterior trim and door and window frames, the *New Era* is one of the most modern and comfortable fishing vessels to be launched in recent months. Built for William Selsel at a cost of \$45,000.00 the vessel is 57 feet long, has a beam of 6 feet 4 inches and a depth of 8 feet, 9 inches. It is planked with 2 inch fir on bent oak frames 2.5 x 3.5 on 12 inch centers. The main engine drives a 1.5 kw., 32 volt generator for ship lighting, while an 8 hp. Lister-Blackstone diesel engine serves a 1.5 kw. generator which power refrigeration equipment and also provides standby electric lighting power. The *New Era* carries an Apelco direction finder, Bendix depth recorder, Jabsco bilge pump and a Pacific Electronics radio-telephone. A crew of 9 men is carried. The *New Era* is sister ship to the *Pamela Rae* which was launched a year ago and last season set the record for vessels fishing out of Petersburg, Alaska, by bringing in 193,000 pounds of halibut in four trips. Sagstad has four other similar boats on the ways, in addition to a 48 foot trawler designed by Ed Monk, all of which will be powered by GMC diesels.

First in the Seattle area to be powered with the

new 110 GMC diesel was the *Hannah-C*, a fish packer of 40 net tons owned by W. S. Balcom. As with all General Motors diesel jobs in the Puget Sound area, this installation was supervised by the Evans Engine & Equipment Co. which has a waterside location on Lake Union within easy access for fishing craft. Affiliated in the firm with A. V. Evans who has been handling GMC engines for 13 years are two sons, C. R. and B. F. Evans. The *Hannah-C* was a repowering job handled at the Evans plant where a parts and service department of 10 men do the complete installation work, including piping, welding and wiring. The company's dock is being extended 450 feet in order to provide increased space for fishing vessels which tie up at the plant. For those boats moored in salt water and as far away as Aberdeen and Hoquiam, two service trucks are utilized by Evans in making installations in the field. Mike Yerkovich, who attended the GMC diesel factory school in Detroit, is in charge of the Evans installation and service work.

The 110 GMC installed in the *Hannah-C* drives the boat at a top speed of 11 knots, with 9.5 knots the normal cruising speed, through a 4.5:1 GMC hydraulic reduction gear. With the engine turning at 1750 rpm., there is 265 hp. on the shaft at 390 rpm. The wheel is a 56 x 42 x 44 variable pitch Coolidge propeller. This 67 foot craft, with a

beam of 17 ft. and a depth of 8 ft., will ice down 30,000 trap salmon for Alaskan canneries. A Delco-Remy, 32 volt generator is run off the main engine for charging Willard batteries utilized in engine starting. The electric lighting plant is a 110 volt Kohler gasoline unit. Power is taken off by chain from the forward end of the 110 GMC for driving a Fairbanks-Morse hold and bilge pump.

The *Sunbury*, a 65 ft. tug owned by the Allman Hubble Towing Co., Hoquiam, Wash., offered a similar repowering job and here, too, a Model 62200 Detroit 110 GMC was installed. This 6 cylinder engine, with a 5 x 5.6 bore and stroke, puts 175 continuous, heavy duty horsepower on the shaft which drives a 48 x 32 propeller. Here again a 4.5:1 hydraulic GMC reduction gear was utilized. The towing company has on order a second 110 GMC for installation in the *Hubble-6* which, like the *Sunbury*, is engaged in towing huge log rafts.

In Tacoma, where tuna clippers aggregating at least \$5,000,000 in value a year are built, the Tacoma Boatbuilding Company is installing two 110 diesels for electric power generation in a clipper scheduled to be launched this spring.

They will drive a pair of 100 kw., 220 volt Westinghouse generators. Three more 110's are on order for a 144 ft. clipper where they will drive 110 volt Delco generators through 3:1 reduction gears.

The first clipper launched in Tacoma this year, the *Golden Glow*, built by the George Peterson yard at a cost of \$320,000.00 was fitted with two 6-71 General Motors diesels for driving 60 kw., Delco generators producing three phase, 220 volt a.c. current for the elaborate Northwest Baker Ice Machine Co. refrigeration equipment, as well as for ship's service. Equipment to be powered here includes Fairbanks-Morse brine pumps turned by

General Electric motors, 8 Jacuzzi brine circulators, three Baker compressors, anchor winch, DeVilbiss main engine air compressor, Jacuzzi fire pump and a Fairbanks-Morse brine transfer pump, all of which are served by Master electric motors. The propulsion engine in the *Golden Glow* is a Model DMG-6, 6 cylinder, 400 hp. Enterprise diesel which drives a 66 x 38 Coolidge propeller to give the ship a cruising speed of 20 knots at an estimated fuel consumption of 20 gallons an hour.

Peterson is building an identical clipper, *Miss California*, which will be launched in April. This ship, too, will be powered with an Enterprise, while a pair of 6-71 General Motors diesels will turn generators. With virtually all Puget Sound district shipyards busy at near-capacity, prospects are that the 6-71 models and the newer 110 GMC engines will move from the Evans company in Seattle as rapidly as they are available.

The *New Era*, combination porse seiner and halibuter, is shown at the outfitting dock of Sagstad Shipyards shortly after launching on January 23. The 57 ft. vessel is powered with a 6-71 GMC diesel engine and will cruise at 8½ knots.

This 67 ft. fish packer was repowered with a new 110 Detroit GMC diesel engine. The vessel will carry 30,000 salmon, iced down, and cruise at 9½ knots.

This sturdy workhorse of the sea was repowered with a 110 Detroit GMC diesel engine for its work of hauling log rafts. It is 65 ft. long and owned by Allman Hubble Towing Co., Hoquiam, Wash.



BIG UTILITY ADDS A DIESEL

THE Western Light & Telephone Co., one of the three largest public utilities in the State of Kansas has expanded greatly its facilities for the generation of electric power. Diesels have long played an important part in this company's activities and internal combustion units have had a major role in the expansion program. Recent installations at seven Kansas generating stations include two steam turbines, two oil-burning diesels, and four dual fuel engines. One of the notable dual fuel installations was at Phillipsburg, Kansas, where a 3,400 hp. two-cycle Nordberg unit is now in regular service. This engine, one of the first of its type, burns natural gas at low pressure with a small quantity of oil as pilot fuel and can be switched instantly from dualfuel to full diesel.

Western Light & Telephone is providing utility services to approximately 47,500 electric customers in Kansas and Missouri, 4,500 water customers in Kansas, 4,500 gas customers in Kansas, and 48,900 telephone subscribers in Kansas, Missouri, Iowa and Oklahoma. Electric production our primary concern in this article, has expanded steadily in recent years. Peak loads have risen from 19,000 kw. in 1943 to 42,000 in 1950 and total production has grown from 69,853,000 kwh. in 1943 to more than 150,000,000 kwh. for the full year of 1950. Total generating capacity has gone from

27,500 kw. to 50,500 kw. and diesel capacity from 10,050 kw. to 22,150 kw.

The use of numerous generating stations, strategically situated in the areas served, enables this utility to render highly dependable service and minimizes the danger of service interruption through transmission line failure. It is equally important, however, to produce power economically and the dualfuel engine is proving itself a good answer to the problem. The Phillipsburg engine, for example, has only been operating on gas since July 7, 1950. According to company records the Nordberg dualfuel has generated over 4,000,000 kwh. up to December 1, 1950 and is averaging 9.703 cu. ft. gas per kwh. at 86% load.

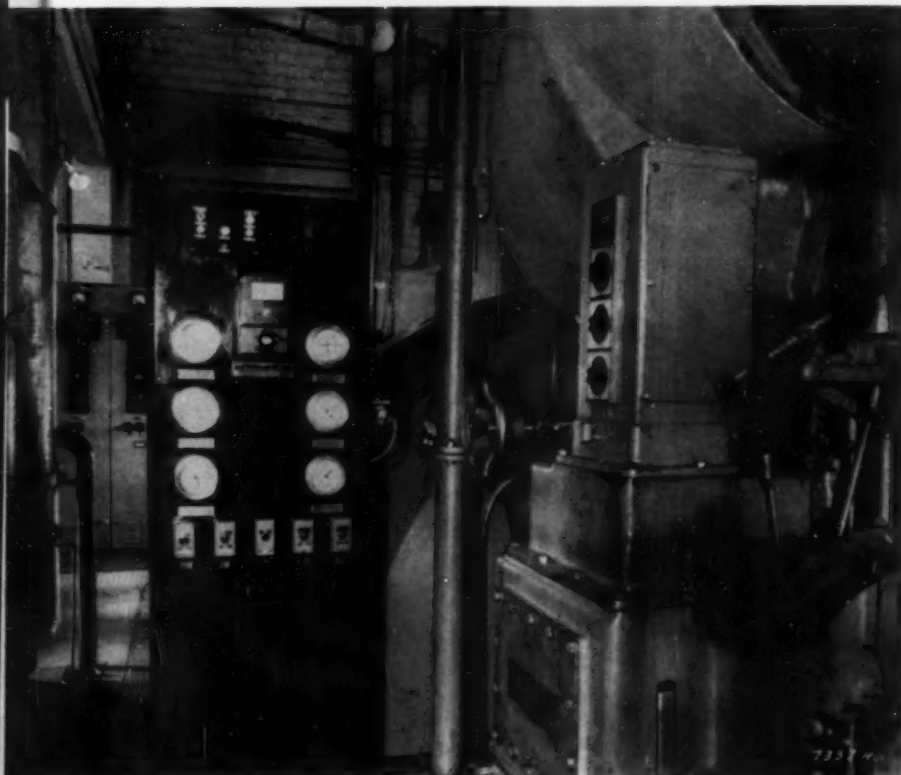
The Nordberg dualfuel is an 8-cylinder engine of 21½ inch bore and 31 inch stroke with a rating of 3,400 hp. 2410 kw. at 225 rpm. At the Phillipsburg altitude of 2,000 feet the unit is rated at 3330 hp., 2360 kw. Until recently there were no 2-cycle engines as large as this which could be switched instantly from gas to oil or from oil to gas. Nordberg has a large number of big, 2-cycle convertible gas engines operating successfully in the field but these units inject gas at high pressure and require several hours to switch to full diesel. With the engine at Phillipsburg, however, gas is used at low

pressure and the engine can be changed from dualfuel to diesel by the simple movement of the control lever.

Gas (with a heating value of 950 btu. per cu. ft.) reaches the plant at 48 to 50 lb. pressure, passes through a meter, then a scrubber and then a regulator which reduces pressure to 20 lb. At this pressure it passes through an admission valve into the engine's gas header and then through an admission valve at each cylinder. The opening of the valves at the cylinders is accomplished hydraulically by individual actuator pumps controlled by the governor. The engine shuts down automatically if lube or pilot oil pressure fails. The pilot oil is injected by the same fuel pumps and injection nozzle used for full oil operation. The pumps are specially calibrated to meter accurately the small quantities of oil required for dualfuel service. The pilot charge is constant. Fuel at Phillipsburg is trucked to the plant from a local refinery and stored in two tanks with a combined capacity of 44,000 gal. A motor-driven transfer pump sends the oil from storage through meters to underground day tanks (a 1,000 gal. tank for the Nordberg). Engine-driven supply pumps take oil from the day tanks through duplex filters.

This engine provides further evidence that dualfuel engines are easy and economical to lubricate. Oil for bearing lubrication and piston cooling is circulated by an engine-driven pump and the circuit includes a shell-and-tube oil cooler. A motor-driven auxiliary lube pump cuts in automatically if oil

Conveniently located near the engine controls and the Woodward governor is a Nordberg gauge board which includes an Alnor exhaust pyrometer, a Viking alarm panel and control switches for engine auxiliaries.



pressure drops. Part of the lube is drawn from the sump by a motor-driven pump and put through an activated clay purifier from which it returns to the sump. Oil is supplied to the cylinders by an individual force-feed lubricator for each cylinder. So far it has not been necessary to add any oil to the crankcase supply. In the first three months of operation, the engine used 816 gal. of oil which figures to about 5.840 hph. per gal. of lube.

Scavenging air is drawn from outside the plant through an automatic self-cleaning filter and an intake silencer to the engine-driven blower. Exhaust gases vent through a vertical silencer. A

separate closed cooling system was installed with the new engine. One motor-driven centrifugal pump circulates soft water through the engine jackets and through a heat exchanger. A second similar pump puts raw water through the exchanger and an induced-draft cooling tower. City water, used for make-up, is treated in a zeolite softener before it is added to the closed circuit. At the side of the Nordberg is a gauge panel which includes an exhaust pyrometer, control switches for motor-driven engine auxiliary equipment, gauges and an alarm panel. Alarms sound and indicator lights go on if jacket water pressure, jacket water temperature, raw water pressure, lube

pressure or fuel oil pressure go outside prescribed limits. The big engine drives a 2,500 kw., 3,125 kva. 2400 volt generator with a v-belt driven exciter. A complete new switchboard was installed at the same time the new engine went in.

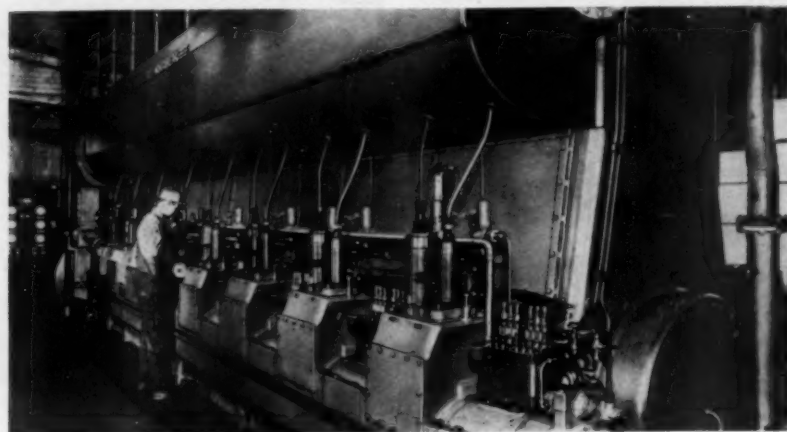
In any multi-plant utility system, maximum efficiency of an individual plant is necessarily subordinated to the efficiency of the system as a whole. Every week, an operating schedule detailing the hours and load of each generating plant is issued from operations headquarters in Great Bend, Kansas. (The chief administrative offices of the company are at Kansas City, Kansas.) For a typical week in October, 1950, the following operating schedule was ordered for the Nordberg dual-fuel:

8 a.m. to 11 a.m.	1700 kw.
11 a.m. to 5 p.m.	1500 kw.
5 p.m. to 8 p.m.	2000 kw.
8 p.m. to 11 p.m.	1500 kw.

Some days the unit is required to pull additional loads up to capacity, depending upon system requirements and conditions. Every prime mover is in effect in competition with all the other available power sources in the utility's system and a regular 15-hour operating day speaks well for the relative economy of the new Phillipsburg engine. It is significant, too, that this expanding, progressive utility, with its long and intimate experience with internal combustion engines, should put so many of its expansion dollars into new dual fuel prime movers.

List of Equipment

Engine—Nordberg, 8 cylinder 21½ inch by 31 inch, dual-fuel engine developing its rated horsepower of 3,400 at 225 rpm.
 Generator—General Electric, 3 phase, 60 cycle, .8 pf., 4160/2400 3125 kva., 2500 kw. Type ATI.
 Lube oil—Socony-Vacuum, Vacme #4 in cylinder, Vacme #3 in crankcase.
 Purifier—Honan Crane.
 Oil Cooler—Ross Heater.
 Lubricators—Mannel.
 Lube Oil Pump—Blackmer Pump.
 Heat Exchanger—Ross Heater.
 Cooling Water Pumps—Ingersoll Rand.
 Cooling Tower—Marley.
 Water Softener—Royal, zeolite softener.
 Fuel oil—Consumer Co-op Association.
 Fuel Oil Transfer Pump—Geo. D. Roper.
 Fuel Meter—Neptune Meters.
 Fuel oil filter—Wm. W. Nugent.
 Fuel injection pump—American Bosch.
 Gas—Kansas-Nebraska Natural Gas Co.
 Scrubber—Blaw-Knox.
 Gas Regulator—Emco.
 Actuator Pumps—American Bosch Corp.
 Governors—Woodward Governor Co.
 Alarm Panel—Nordberg.
 Pyrometer—Alnor, Illinois Testing Lab.
 Alarms—Viking Instruments, Inc.
 Gauges—Lomergan.
 Switchboard—General Electric Co.
 Air Filters—American Air Filter Co.
 Blower—Roots-Connersville.
 Exhaust Silencer—Maxim.
 Intake Silencer—Maxim.



RICHFIELD'S NEW PIPELINE

By JAMES JOSEPH

ATHWART the 4000 foot high Ridge Route, which stands like a barrier between California's oil-rich San Joaquin valley and Southern California are two new pumping stations which lift oil from the San Joaquin and Cuyama valley fields up over the hump via a new 14-inch line, and deliver 75,000 bbls. a day to Richfield's Los Angeles harbor refinery. The new line, plus an existing 10-inch pipeline built in 1925, have upped Richfield Oil Corporation's total delivery capacity from the two fields to 105,000 bbls. a day. Both lines terminate at Richfield's harbor area Watson refinery. Nordberg engines, combined with a unique heat exchanger cooling system, make these stations a story of diesel efficiency.

Each of the new pump stations, one at Wheeler Ridge, elevation 790 foot, the other at Tejon, elevation 3075 foot, are installed with three Nordberg, supercharged, 4 cycle, dual-fuel diesel engines rated at 1050 hp. each at sea level or 987 hp. at 3075 foot, the elevation at the Tejon station. The engines are 7-cylinder, 43 inch bore, 16½ inch stroke and operate at 450 rpm. Each engine drives a Byron Jackson 6 x 8, six stage, horizontal split case, centrifugal pipeline pump through a Western Gear Works speed increaser having a ratio of 1:8 (450 to 3600 rpm.). The pumps have a rated capacity of 39,000 barrels per day, 1000 psi. when pumping crude at 33 A.P.I. gravity.

The new 14-inch line spans 112-miles of plains and mountains and roughly parallels the 125-mile, 10 inch line which runs from the Buena Vista Lake station, about seven miles east of Taft, Calif. There were two very good reasons for Richfield's \$7,000,000 investment: increased civilian demand for petroleum products in the west, and accelerated demand by the armed forces. To supply these, the oil company rushed the line and its two pumping stations to completion, had them finished by February 1st. The new stations supplement, although working independently, five pumping facilities already built and operating along the 10-inch line. This makes seven pump stations in all along the San Joaquin to southern California route, all of them diesel.

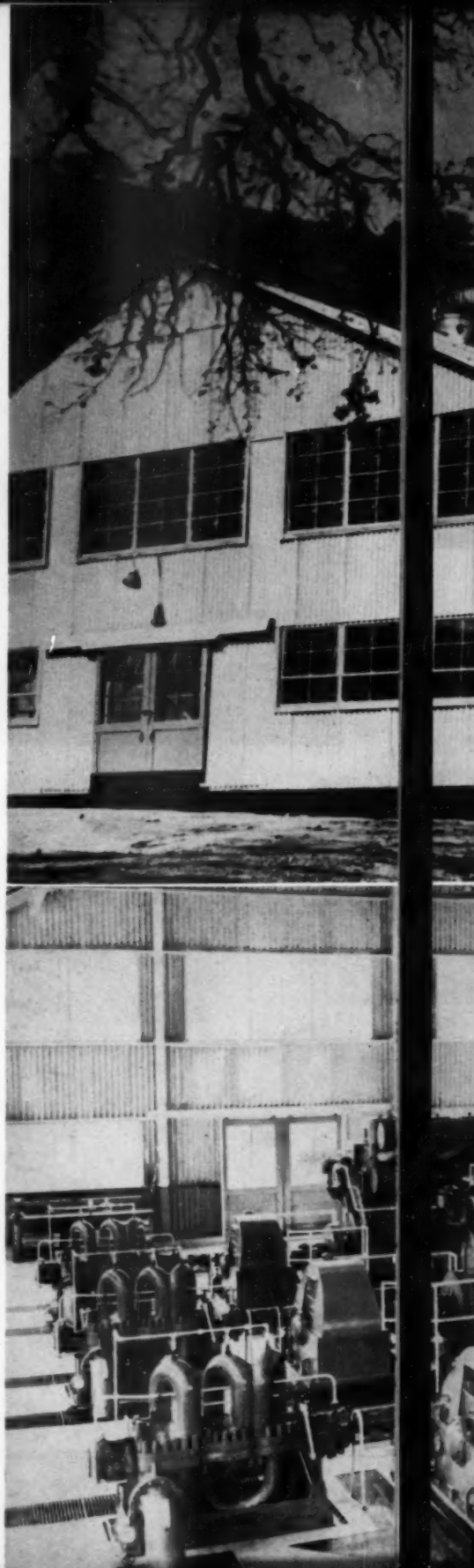
Both new stations are identical. Each has three Nordbergs, one for standby; each has adjacent tanks for crude oil storage. The Wheeler station has three storage tanks, two of them 37,500 bbls. capacity, and another 54,000 bbls. At Tejon there's a smaller tank farm, with two, 37,500 bbls. storage units. Between the Tejon and Wheeler stations, the 14-inch line is 16-inch because of hydraulic design techniques. Higher grades of steel used in the manufacture of the pipe allowed higher operating pressures for a given pipe wall thickness, resulting in considerable savings in both steel tonnage and in total station cost. The pipeline which was both electric welded and seamless, has a wall

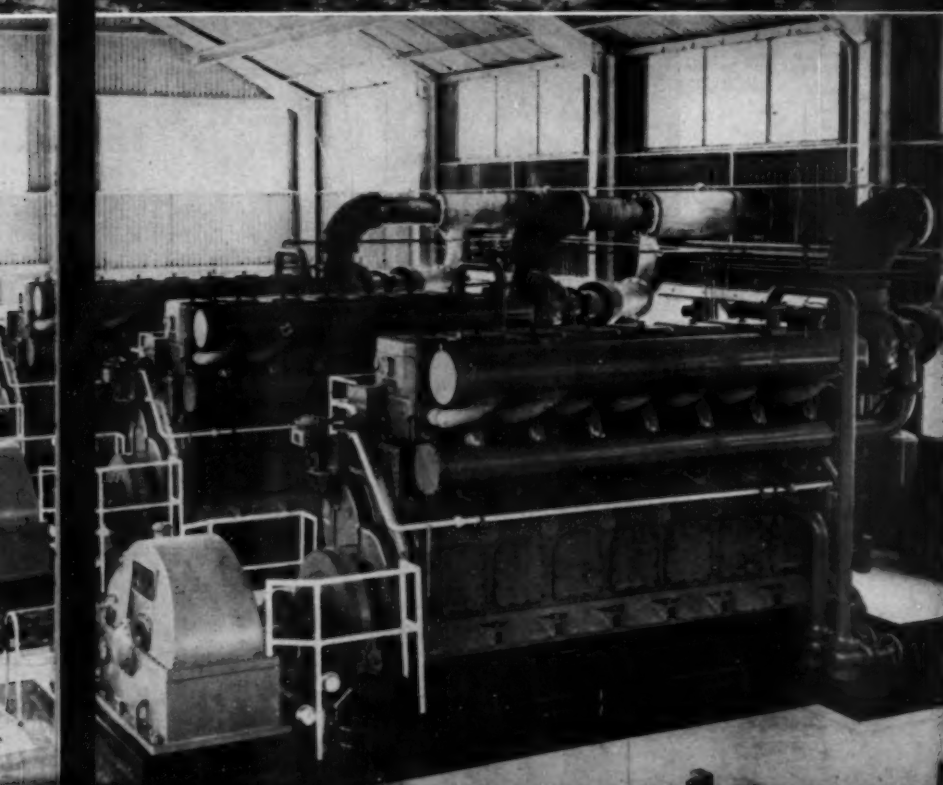
thickness varying from ¼-inch to ¾ inch. The 16-inch's wall varies from 9/32 to ¾ inch. Diesels at each station are automatically controlled from a central control panel. This central control station gauges the discharge pressure of the line; the pressure into the pumps; the discharge flow into the line. There is an Alnor pyrometer which tells the operating engineer the temperature of the oil in the discharge end of the line — toward Los Angeles.

An engine control selector switch allows the control-room operator to set the amount of crude flowing through the line. There are also gauges telling the discharge pressure of each of the three Byron-Jackson pumps and remote Weston tachometers reporting the actual ppm's of each Nordberg engine, ranging from 0 to 800 rpm. with the average operating rpm. between 400 and 450.

The dual-fuel features of the Nordbergs were especially advantageous for Richfield since it had the crude right at the site. Although the stations have just begun operation, Richfield engineers plan to run the diesels 10 per cent on crude-oil and about 90 per cent on natural gas. Richfield's older stations on the Ridge Route, each of which has two air-injection Worthington diesel engines, rated at 300 hp. or 600 hp. per station, run 100 per cent on crude oil. The diesels at these stations power Wilson-Snyder reciprocating pumps. Crude for fuel is tapped from the main trunk at the new stations and is run through a Sharples, maximum 15,000 rpm. centrifuge to remove impurities. The crude oil to fuel oil centrifuge has a 500-gallons an hour capacity. After cleaning, the fuel oil is pumped into one of two, 3000-gallon storage tanks located outside the plant. A second Sharples centrifuge removes impurities from the lube oil, from where it flows into a storage tank and is later pumped into a 265-gallon day tank. The centrifuges have sufficient capacity to clean and store enough fuel oil to run the plants in case of a total gas shut-off. In case of a gas failure, the engines go automatically onto crude.

Probably the most interesting feature of the Richfield pumping stations is the extensive use of engine cooling water to both cool and heat various liquid components of the system. Ross Heat exchangers are used in the process. Heat exchange is used on the jacket water cooling, on engine lube oil cooling, for gear oil, as fuel oil heaters, and even to warm the oil in the main trunk pipeline. Here's how it works: Engine jacket water at 160° F. and 380 gpm. goes to a jacket water pump (one for each diesel engine, of course). These are Ingersoll-Rand pumps, motor-driven by a 15 hp. electric motor. At the jacket water pumps, the engine water is split about 70-30. Seventy per cent flows back to a common point through a fixed bypass to the engine. At the split, 263 gpm. (the 70 per cent) at 160° F. flows back to the engine;





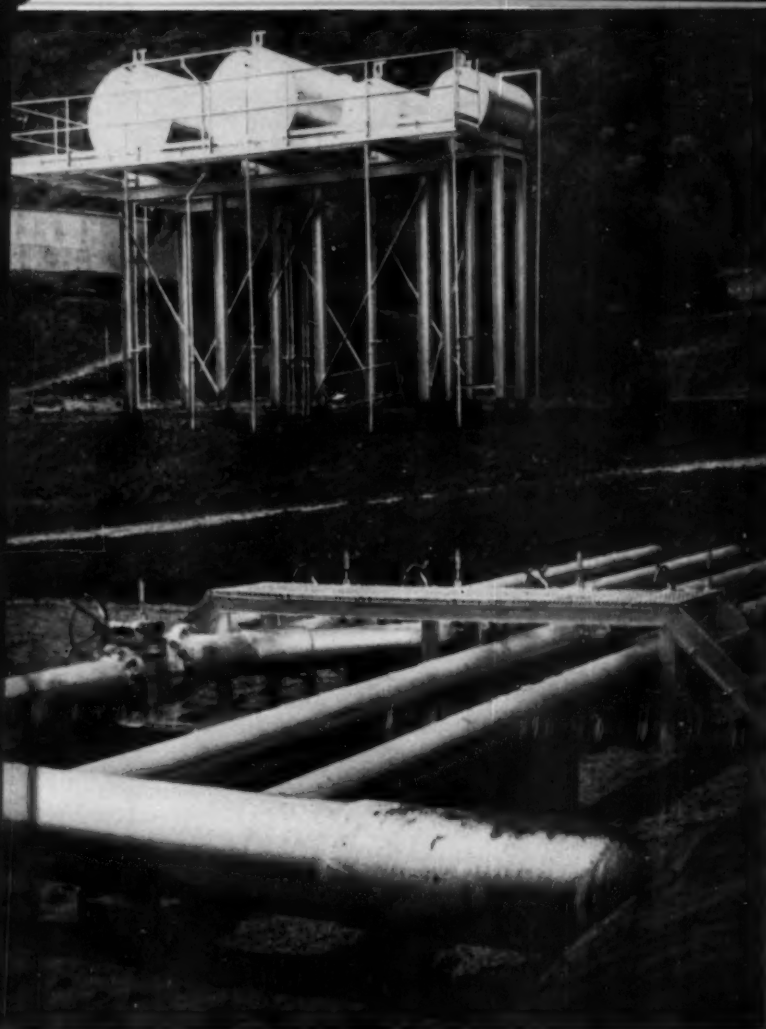
117 gpm. (the 90 per cent) at 160° F. flows to one of three jacket water coolers. These coolers are manifolded interchangeably with the jacket water pumps. Oil from the main pipeline at 1140 gpm. at 90° F. is split in half and passes through the tube side of the jacket water heat exchangers to the suction side of the pumps, and emerges about 10.3° F. warmer— which makes the crude more viscous, thus it flows more easily and with less friction through the main pipeline. Meanwhile, in this heat exchange, the engine cooling water has been lowered from its original out-of-the-engine 160° F. to 118° F.—a drop of 42 degrees. The engine cooling water now flows through a gear oil cooler (at the pumps). In this exchange, the engine cooling water picks up about .5° F., so that it leaves the gear oil cooling jacket at 118.5° F. while the gear oil loses 10 degrees in the process. Gear oil which had entered the cooling jacket at 25 gpm. at 135° F., emerges cooled to 125° F.

The engine cooling water continues at 118.5° F. and next enters an engine lube oil cooler where it picks up about 7.3° F. rising to a temperature of 125.8° F. At this point, the engine cooling water would be too cold for the diesel engines. However, just before re-entering the Nordbergs, it merges with the by-passed 70 per cent cooling water which had been shunted at the jacket water pump. Since this by-passed water is 160° F., it mixes with the returning cooling water and reenters the Nordbergs at the full 380 gpm. and at 150° F.—or 10 degrees cooler than when it left the engine. All of which makes Richfield's new pumping stations' heat-exchanging system about as efficient as any in the nation.

Incidentally, before the 70 per cent by-passed cooling water returns to the diesels, it passes through a fuel oil heater—which warms the fuel oil to proper operating temperatures. Another innovation is jacket water controllers—which automatically control the temperature of jacket water coolers to make sure that the water leaving is the correct, designed temperature. This control is accomplished by an automatic 3-way valve which by-passes engine cooling water away from the jacket if the outgoing water is too hot, or allows greater quantities to flow through if the discharge water is too cool. The aim at all times is a discharge temperature of 118° F.

A Honan Crane oil purifier—one for each engine—is rigged to purify approximately 10 per cent of the engine lube oil flow at any given period. The job of purifier is to remove oxidation particles from the lube oil, and it accomplishes its assigned task with a shunt-type system, utilizing a filter in conjunction with a small pump and motor.

A third pumping station, somewhat smaller than the new facilities, is being built by Richfield from the Cuyama field to the Wheeler Ridge station. This is a feeder pump station, feeding additional quantities of Cuyama oil via a 10-inch pipe. This station will have three, 300 hp. Atlas Imperial engines in series, driving Byron-Jackson pumps through Western Gearing, for a total of 45,000 bbls. a day. These diesels will be in series, in contrast to the paralleled hook-up of the Nordbergs at the other two new stations.

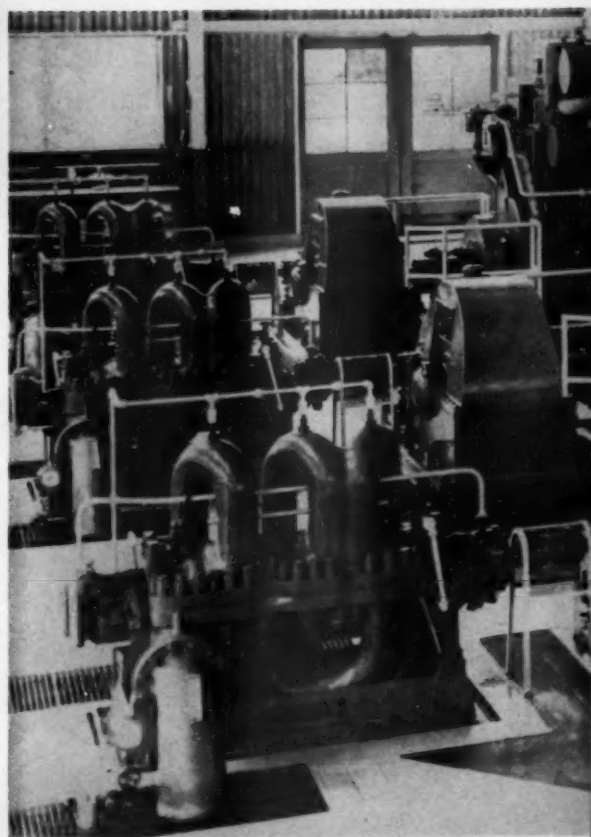


With manifold system in foreground, fuel oil, lube oil, and diesel fuel storage tanks are seen in background. Tanks, left to right, are: two 5000-gallon fuel oil storage, diesel oil (fuel) storage, new lube oil.

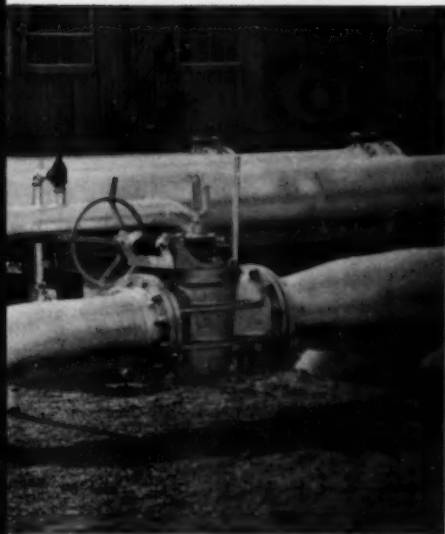
Another interesting feature of the Nordberg installations is the Woodward governors on each diesel engine, controlled by Bristol air-actuated valve positioners which get their air pressure from a metering system located in the main crude line and controlled by the flow of crude oil. While the actual amount of flow through the stations—and thus through the main crude line—is regulated from the control room, this governor automatically speeds up or slows down the diesels through a 10 per cent variance from the set position according to the amount of flow through the main line. If more than 10 per cent variation is desired or demanded, the flow control through the pipe must be set at the control room. In effect, the governor—actuated by linkage and pneumatic transmission from a remotely located flow regulator in the main pipe gears the diesels and the pumps to the demands of the line. The manifold piping at each station allows crude from various incoming lines and from the storage tanks at the site to be shunted through the station as the need arises. Thus, if flow from the valley fields is shut off for any reason, crude is withdrawn from storage tanks at the pump-station site, with no slow-down or interrup-



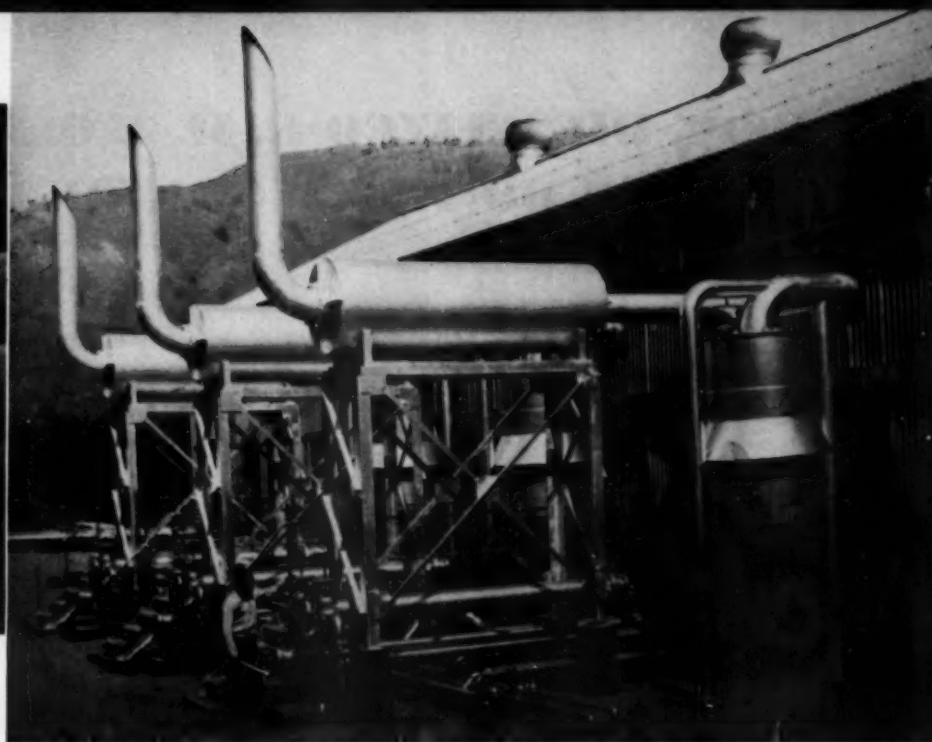
Charles Miller, pipeline engineer, looking over the Row jacket water coolers outside the Tejon station of Richfield's new pipeline from San Joaquin and Cuyama valleys to Los Angeles.



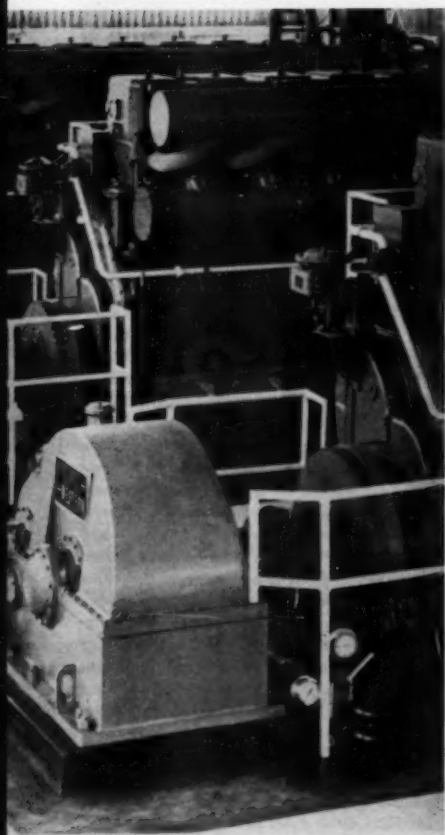
DIESEL PROGRESS



Three 7-cyl. Nordberg supercharged, 4-cycle dual fuel diesel engines direct connected through Western gear speed increasers to Byron-Jackson pipeline pumps at new Richfield Tejon station.



Maxim silencers and American air filters at the rear of the Tejon Richfield pipeline station.



tion of flow except that time involved actually valving the manifold systems for the new condition. The manifolds are equipped with strainer valves installed to help clean up the crude before it flows through the jackets and pumps.

At the present time, as this is being written, the natural gas to the diesels has not been fully installed, and the engines are running on crude. Gas hook-up is expected momentarily. Each station has a fuel oil, lube oil and diesel fuel storage area, with the tanks mounted for gravity feed. There are, as we mentioned, two, 3000-gallon fuel oil storage tanks; in addition, there's a 500-gallon diesel oil storage tank and a 1000-gallon lube oil storage facility. The lube oil tank will hold clean, new lube; the diesel oil will be used to run the engines about 15-minutes when they're started up initially and again 15-minutes before they are shut down, which will help to clean out any carbon left from the crude.

Each engine is equipped with Cycoil-type American Air Filters, with a 5000 cu. ft. per minute capacity; with Air Maze air silencers and Maxim exhaust silencers. In many ways, Richfield's new pump stations are a maintenance man's dream. Temperature gauges on the units as well as in the central control room make log-taking a comparatively easy job. Hourly checks are taken on all components, and this information is condensed on two sides of one log-sheet. Operating engineers will log, for instance, the circulating water system, lubricating oil, fuel exhaust temperatures, lube oil, and bearing suction discharge.

Richfield calls its installation one of the most modern pipe lines ever built in California, and de-

signed the 14-inch line for maximum efficiency. Walls of the pipe vary in thickness, as we've noted, being heaviest where greatest pressure prevails. This meant a considerable savings in steel. Sectionalization gates installed on either side of all major stream crossings and at other critical points in the line prevent loss of oil in the event of line failure. Incidentally, the line was designed and built for the operation of scrapers which remove deposits and thus keep efficiency at maximum. Top quality bitumastic coating protects the entire length of pipe. With completion of the final section—a 54-mile segment between the Wheeler Ridge pump station and Newhall after 15 months' work—Richfield has a total of 714 miles of trunk and gathering lines from its central California and other fields, into its refineries.

The complete installation of pipeline and pump station was completed under direction of Jack Lynch, special project engineer of Richfield's pipeline department, of which N. F. Anderson is manager. The technical problems involved in installing the Nordbergs were handled by Charles G. Cox, Nordberg's west coast manager.

Incidentally, Cuyama oil requires no special handling or treatment since it is light oil, about 32° A.P.I. gravity and with a viscosity of 120 Saybolt seconds universal. Richfield was fortunate in that it had pumping station sites already laid out, in fact, as we've said, is operating five diesel-pump stations on its 10-inch line. Both the Wheeler Ridge and Tejon stations now contain two pumping stations, operating completely independently — the new facilities for the 14-inch line and the old for 10-inch. This helped reduce plant-site expenses for the company.

100% DIESELIZED G. M. & O. MAKES FOUR DIESELS DO THE WORK OF 15 STEAMERS

3,000 Mile System Formed From Three Busted Shortlines Is World's First All-Diesel Railroad

By CHARLES F. A. MANN

SO RAPID has been the spread of diesel throughout America's railroad network that it is becoming customary to assume there are no more "Firsts" and that the same old pattern fits every railroad picture. Few genuine big-league railroad promotions have been put together in the first half of the twentieth century. In fact, America is getting accustomed to the same boxcar labels in an unchanging pattern since Grandpa's time.

Ten years ago the beginnings of what is now a 3,000 mile Great Lakes to Gulf trunkline system, known as the Gulf, Mobile & Ohio, took place largely under the hat of President I. B. (Ike) Tigrett, from a small office in his country bank in Jackson, Tennessee. In 1912 he took over the management of the 49 mile Birmingham & Northwestern, which ran from his home town to Dyersburg, Tenn. Later two more were added to form the Gulf, Mobile & Northern. Finally, with the impetus of putting together what were actually busted, bumpy old southern logging railroads, into little trunklines that ran somewhere, Mr. Tigrett conceived the idea of stringing together three more systems that were badly bent, into a Great Lakes-Gulf Trunkline system.

Drawing on the revived forest industry of the lower two-thirds of his territory—once given up as forever lost, — largely because pine trees have a nice habit of growing like weeds despite the neglect of civilization . . . the mid-south region tributary to the Gulf has had a great comeback in forest products and pulp and paper. Up north, the Baltimore & Ohio Railroad was stuck with the management of an almost busted Alton Railroad, largely a short speedway between St. Louis and Chicago, and no freight feeders. The B & O, an east-west trunkline, forever got in the traffic doghouse with competition by trying to operate a north-south line like the Alton. So the Alton decayed into what Vice President G. P. Brock, the genius who repowered a whole system in one \$60,000,000 swoop, termed a "railroad with everything on it busted and broken". The Mobile & Ohio and New Orleans Great Northern, two more

railroad lemons, were eyed. Finally, all four companies were consolidated into the Gulf, Mobile & Northern and the amazing process of standardization of all the assorted junk and facilities on all these decayed little systems, into a unified efficient property was begun with such speed and careful planning that the railroad industry saw in a period of less than 36 months, a 3,000 mile trunkline railroad scrap nearly 400 of the most widely assorted variety of steam locomotives, replace them with nearly 250 units of diesel, and convert a whole system organization of manpower and facilities from steam to diesel on a tight-calculated basis never before tried by any railroad anywhere.

Not only did the \$60,000,000 diesel program loom large in ratio to the total capitalization of the system, but biggest of '1, over \$50,000,000 was saved outright in not having to replace two-thirds of the rail mileage with heavier steel and not having to rebuild some 400 bridges to hold today's modern heavy steam!

With President Tigrett's imagination, financial wizardry and salesmanship, coupled with the disarming tradition-free, shrewd operating brain of Operating Vice President G. P. Brock, down in Mobile, the Rebel Route shoved steam clear out of its whole life with the ease Junior upsets the whole household on Sunday morning, and fined down the diesel approach far ahead of any other railroad by actually grouping the morning locals, the Branchline headache-operations and the way freight runs into groups that could be hauled by one or two diesels working around the clock instead of a costly old teakettle hooked to each separate jerkwater local! Systemwide this was quite an ingenious chore, and the locomotive industry gives the Brock-GM&O team full credit for being largely behind the evolution of the road-switcher type of diesel locomotive. The road-switcher, like Willie in the comic strips, "Can Do Anything"!

Today, at the end of the first full year of 100% dieselization on the Rebel Route through mid-America, all the queer old steam teakettles, most

of them dating back to World War I, all the way-side roundhouses, water and fuel stations, cinder pits and hoists, pump houses etc. and two of the largest shops are gone with the wind—Southern Style, if you please! The company is piling up world records in streamliner passenger mileage between Chicago and St. Louis; constantly raising the tonnage-average of its freight trains; the average speed per hour of these trains; the utilization hours of its switchers and finding how to convert diurnal branchline operations to black ink by revamping the timetables so the light diesels runs the same total daily hours as does the mainline power.

The GM&O will pay off its entire equipment debt out of diesel profits within ten years! So they're smoking longer cigars down on St. Francis Street, in old Mobile-by-the-Gulf these days and definitely proving to themselves that you can still run a mainline railroad safely and swiftly on 90 lb. steel rails provided you throw steam power off the lines entirely. Nobody else tried it before.

The Alton Railroad was America's first railroad to operate a detached diesel locomotive. Prior to that time the streamliner idea had diesels in one cab of an articulated train. First tried on the parent B & O railroad, the Alton received an Electro-Motive creation, a 2-unit 3600 hp. detachable locomotive, which went into service in August, 1935, pulling the St. Louis-Chicago streamliner "Abraham Lincoln". Just one month earlier, the Alton's eventual new owner, the Gulf Mobile & Ohio purchased, in July 1935, two Alco-McIntosh & Seymour Diesel engines to power the "Rebel" streamliners on the New Orleans-St. Louis run, one of which was the second unit of railroad diesel power to be manufactured in the U.S.A.! Thus the Rebel Route pioneered along with the Burlington, Union Pacific and Central of New Jersey, the whole U.S.A. diesel railroad field, and it is proper that it should become the first all-diesel railroad.

Actually it is remarkable that an entire 3,000 mile railroad system can be operated to capacity with but 243 units of diesel power totalling 338,740 hp.



Engineer Phillips shows GM&O Vice President and General Manager G. P. Brock his orders as *The Rebel* prepares to leave Mobile.

Ownership is broken down as follows:

SWITCHERS: 27 ALCO—1000 hp., 4 ALCO—600 hp.; ROAD SWITCHERS: 34 ALCO—1000 hp., 18 ALCO—1500 hp.; PASSENGERS: 7 EMD—2000 hp., 1 EMD—1800 hp., 6 ALCO—2000 hp., 2 BALDWIN—2000 hp.; FREIGHT-PASSENGER: 12 EMD—1500 hp.; FREIGHT: 88 ALCO 1500 hp., 42 EMD—1500 hp., 1 INGALLS—1500 hp.

Because the Alton part of the system started out with primarily Electro-Motive GM diesels, and because the Gulf Mobile & Ohio part of the system began with Alco's, this operating pattern has tended to hold since. Most remarkable diesel utilization, is, of course, possible on the high speed St. Louis-Chicago passenger runs. In actual practice the EMD passenger diesels make $1\frac{1}{2}$ round trips each 24 hours, and make as high as 16,000 miles a month. The entire system is now operating in excess of 500,000 miles of diesel passenger and freight per month. During the first 10 months of 1950, the system totals were 3,213,550 diesel miles in freight service and 2,067,422 miles in passenger service, and 508,588 miles in rail motor-car service on secondary lines, or a total for 10 months of 5,789,560 miles.

Through freight service the average mileage per month for diesel freight locomotive units exceeded 6500 per month while on local freights the mileage was nearly 3400 per month per diesel unit. The system averages were in excess of 11,000 miles per diesel unit per month. Obviously all this explains why a grand total of but 158 road freight and passenger diesel units averaging about one-third the unit horsepower of a like total of steam engines, plus 52 road switch diesels, were able to completely replace nearly 400 steamers!

The scrap plant at Jackson, Tenn., the President's home city, did a land office business in ending forever the day of steam on this railroad, and the statistics developed by their diesel successors justified this bold move of complete modernization. High point of diesel utilization is reached on the fast passenger run between Chicago and St. Louis. Five passenger trains are operated in each direction daily, with 2-unit, 4000 hp. diesels employed. For these five runs, ten single trips of 284 miles each, four—4,000 hp. diesels replace 15 steamers formerly needed to operate the service! Where long service periods were needed with steam operation, a crew of service men can do a diesel in $2\frac{1}{2}$ hours!

The fast system-wide changeover from steam to diesel made it necessary to scrap every trace of the old methods and facilities. Some 96 water tanks, 23 coal chutes, 21 water treating plants, 8 coal facilities, 19 cinder facilities and 38 pump facilities were scrapped. The large general shops at Bloomington, Illinois, were completely abandoned and three large manufacturing industries replace the once large railroad payroll. A thorough program of training the old crews in the ways of the diesel was done at great speed with a flying wedge of 20 bright young men, a diesel instruction car and the supervisory personnel. Every steam facility was either completely converted to diesel or abandoned entirely; old tools scrapped and as much of the old equipment converted to other uses as could be done, the rest junked and written off. The company has gone to great lengths to replace its abandoned facilities with types of industrial payroll that could absorb all of its older displaced steam power personnel—even at a sacrifice of railroad freight tonnage. The sons of the Bloomington blacksmiths now run a cellulose factory or operate a diesel switcher!

Down in Mobile, Operating Vice President G. P. Brock is rubbing his hands together pleasantly as the statistics of this remarkable 100% dieselization program pile up. Headaches with the first round of operations with new motive power, strange to both the labor force as well as management, have melted away, and, as expected, the first year's "gravy" statistics with everything new and not needing routing maintenance on the scale that inevitably arises in the second, third, fourth and subsequent years, are behind the GM&O and the whole system is now set to share in the great mid-continent Great Lakes-Gulf traffic that rises each year as America rediscovers its great Gulf Coast.

At the end of the first full diesel year, freight train average speed had risen to 19.1 miles per train hour, up 20% over the last year of steam! Tonnages of diesel freights passed the 3001 ton mark, up from a mere 2049 tons in 1945, or an increase freight train tonnage of 38% with diesels over steam. Gross ton miles per train hour rose from 35,047 in 1945 to nearly 57,000 in 1949 with diesel! Enough to make an operating executive ask for a raise in pay!

On the passenger side, with 2084 miles of the system, some 2,414,071 passenger train miles were operated, or about a million miles less than the diesel freight train miles. On the switching side, the most notable performance showed in the hours worked per yard diesel per-day. It averaged 10 hours per day with steam and 12.7 with diesel, while the total switching hours for 1949 totalled almost exactly 700,000 hours for the system, all but 30,938 being diesel switch hours. On Fuel consumption, the system totals were 18,647,008 gallons of diesel fuel purchased for road freight service; 2,680,245 gallons of yard switch service and 5,401,254 gallons for passenger service. Fuel oil costs for the year were 9.31 cents per gallon, at point of production or purchase and 10.06 at point of use. Coal costs comparison-wise, were \$5.08 per ton. In freight service, the consumption of fuel per 1,000 gross ton miles, the infallible yard-

stick used straight across the railroad board, was 1.5 gallons, and for passenger service was .28 gallons per passenger car mile. GM&O's fuel bill for the year was 90% diesel purchases. Freight diesel locomotive miles run per day rose from 109.5 to 139.7 while the passenger locomotive miles per day rose from 211.8 to 250.5. Which shows what high utilization can be accomplished systemwise, despite the reduced averages branch line and local service inevitably brings.

At the close of 1950, the company's record with diesel for the first 10 months of 1950, as compared with the first 10 months of 1949, turned up the following digest of diesel costs, reflecting the growing pressure on railroad operating costs from a labor standpoint. Note carefully the fuel costs were the only thing in the twin tables to show

a reduction. Diesel users everywhere please note.

GM&O Costs Per 1,000 Gross Ton Miles

	1950	1949
Enginemmen and Motormen.....	\$0.1182	\$0.1150
Fuel .....	.1583	.1706
Water .....	.0010	.0031
Lubricants .....	.0130	.0129
Other Supplies .....	.0019	.0014
Locomotive Repairs .....	.2351	.2019
	\$0.5275	\$0.5049

Locomotive Mileages

	1950	1949
Loco. Miles, Freight	3,213,550	3,129,418
Loco. Miles, Passenger	2,067,422	2,049,546
Passenger Motor Car Miles	508,588	683,092

Locomotive Repair Costs

Freight—Based on 11,196,280,000 gross ton miles were \$.2186 per 1,000 GTM's; \$.6585 per train mile and \$.2635 per locomotive unit mile.

Passenger—based on 2,414,071 miles, were \$.2539 per train mile and \$.1671 per loco. unit mile. Switching costs were \$.1646 per switch loco. mile.

A 3000 mile, 100% dieselized trunkline railroad is an accomplished fact—for the first time in world railroad history!

The diesel savings will pay off the entire cost in 12 years, including interest, and the \$50,000,000 that would have had to be spent in addition for heavier bridges and rail will probably guarantee the stockholders a nice return for the rest of this century!

A specially constructed "schoolroom car," built in the GM&O Frascatti Shops, Mobile, Alabama, aids in teaching veteran crew members and maintenance personnel in the operation of the GM&O's new diesel freight and passenger units.



A 50-year-old water tank crashes to the ground, symbolic of the GM&O's transition from steam to diesel. In all, 96 of these tanks will be dismantled along the 3,000-mile system.

The Ann Rutledge, crack GM&O streamliner, as it crosses one of picturesque bridges along the scenic route from St. Louis to Chicago.

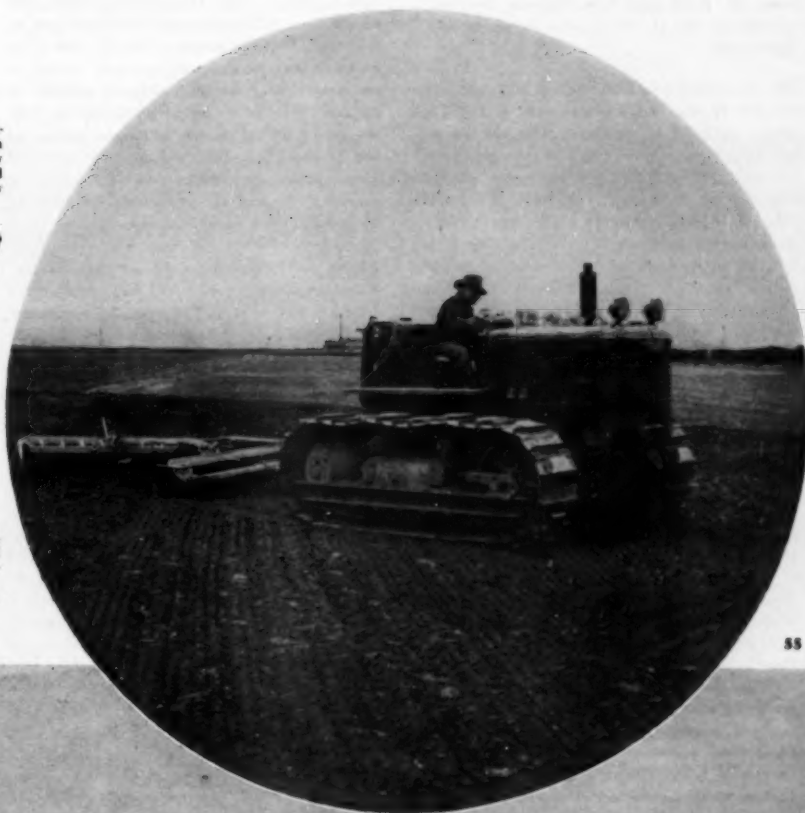


WESTERN FARMERS GOING TO SEED!

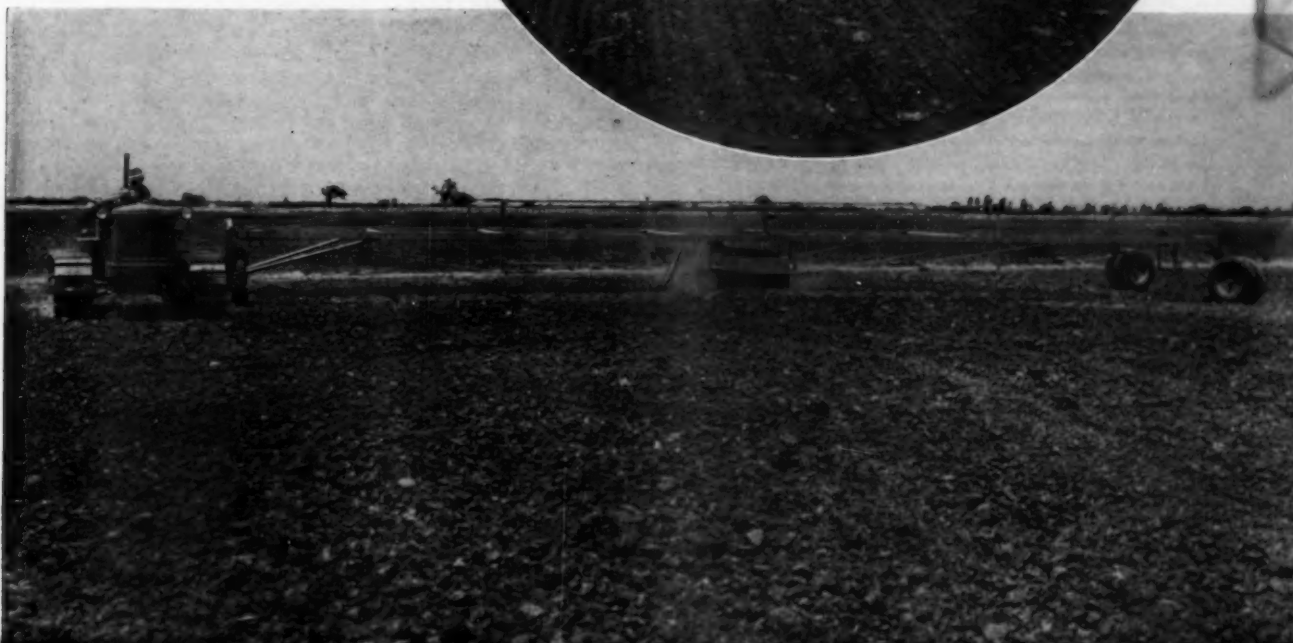
**Growers in Idaho, Oregon, California Find Production of
New Varieties of Soil Building Grasses A Second Gold Rush
For Those With Know-How And Equipment.**

By F. HAL HIGGINS

International TD14 diesel crawler tractor pulling heavy-duty disk harrow in preparing seed bed for one of the new clover crops that are turning into gold mines for the farmers with know-how in seed production.



Cat. D6 diesel tractor pulling 80 ft. Marvin Landplane as it prepares field for alfalfa seed crop in northern California.



THE national demand for more soil building crops for pasture, hay and ensilage has opened to the best farmers in certain areas on the Pacific coast one of the top cash crop fields in the history of agriculture. Oregon, Idaho and California are each producing millions of dollars worth of Ranger, Atlantic and Buffalo alfalfas, Ladino and Kenland clovers, etc. Your Old Reporter has just returned from two little trips up the Sacramento and San Joaquin valleys where he saw such rich harvests of these popular grass seeds he wondered what the gold hunters of a hundred years ago would think were they to get a look at today's take that is annually being harvested by farmers almost within sight of the diggings along the Mother Lode that was productive to only a few lucky ones and then for only a few years. And up in Oregon and Idaho where the writer made trips this year, the smart scientific growers in certain areas are on the seed "gold train."

The soil conservation work of U. S. and state over the past 20 years has begun to make every U. S. farmer soil-building conscious. Also, the rise of live stock in years of war and post-war prices has increased the need for more and better pasture and hay for dairy and beef cattle, sheep and poultry. So, our U. S. and various state agricultural experiment stations have been hunting down and developing more and better strains of the old stand-by clovers and alfalfas. From Italy has come the Ladino clover, a droopy-headed white plant that has gradually caught on over the past 30 years since introduction to the U. S. Suddenly the whole U. S. farming area, practically, has discovered its fine qualities for pasture. Buffalo was developed in Kansas. Atlantic is a 11-variety development for leaf disease resistance. From Nebraska comes the new hardier strain of alfalfa called Ranger. The Corn Belt states are taking all they can get from our Western growers. And then there are the other grasses like Safflower, which is beginning to get a wider play with acquaintance.

Like all western crops, each must fit into the mechanization picture to permit "mass production" with few hours of skilled labor on dieselized machines. The fact that the best farmers in many areas are getting into this seed production program on a big scale indicates the fact that it is not confined to certain small areas of soil and climatic conditions. Take Ladino, one county in central Oregon is running neck and neck with Glenn County, Calif., for the world's capital in that seed production. Says Jack Pickett, associate editor of California Farmer, who has been looking into this new "Oil well gusher," as he calls it after sizing up the facts: "Shop in California for your new styles. The U. S. is undergoing a roughage revolution. The plant breeders have suddenly blossomed out with a lot of new improved varieties of alfalfa, clovers and grasses. The nation is ripping up its alfalfa fields to reseed to the newcomers, Ranger, Buffalo and Atlantic alfalfas. California is gunning for the Nation's alfalfa seed business and just about has it in the bag. Her love for mechanizing the job, her long season and her jealously guarded reputation for highest unadulterated quality, have succeeded. She is taking a huge 26½ million pound crop of alfalfa seed off her golden acres this year. Some 4.3 million pounds will be the new certified

Ranger and Buffalo alfalfa seed used in the East. The USDA is calling for a 900% increase in Ladino in the next 10 years. At present California grows half the Nation's Ladino seed, or some 3,800,000 pounds this year. Everybody is pushing for more livestock and more pasture. Every state in the Union has recommended through their University Extension agents that Ladino is planted in pastures. Never has a crop swept the country in popularity as Ladino has done. They are pushing California into prosperity because this state produced more than half the Nation's supply of Ladino seed in 1950, with an estimated 3,400,000 pounds out of the 7,570,000 pounds we will harvest.

"California, Oregon and Idaho have this lush business tied up. Support price for certified seed is \$1.25 a pound. The USDA experts estimate that we will need 12,384,000 pounds of Ladino seed by 1955 and 14,855,000 pounds a year by 1960, if all goes well with the economic machine. As new as are these alfalfa varieties, California grabbed off the lion's share of the seed reproduction in 1949. We have 2,800,000 pounds of Ranger coming on and 1,500,000 pounds of Buffalo about harvested for shipment east. California had a 26½ million pound alfalfa seed crop last year and averaged 231 pounds of clean seed to the acre. Keep that figure in mind when you compare it to the U. S. average of 129 pounds to the acre thresher run. These specialized varieties will soon supplant the 7,788,000 pounds of seed imported into this country last year. There isn't any reason why California shouldn't raise that extra seven million pounds. It is interesting to note that about half of our big alfalfa seed crop came from the Imperial Valley last year. Some growers down there are taking two seed crops a year from the land.

"We have sewed up the Nation's alfalfa seed with our beautiful, big, plump seed, attractively packaged, and with our jealously guarded reputation for an unadulterated product. A lot of the Nation's breadbasket nitrifies itself with Red Clover. We plant over 100,000,000 pounds of this seed a year across the U. S. Here again we have something new up the sleeve. It is called Kenland clover, an improved Red clover. It has disease resistance, which this crop has needed, and should be a very popular type of Red clover. The USDA thinks so much of this clover that it is trying to stockpile some of it and offered a support of 42c a pound for 1950, which is higher than the support for Ladino or the new alfalfas—Atlantic, Buffalo and Ranger — all pegged at 40c for Certified seed.

"The first report on Kenland as a crop in California comes from Yolo, Colusa and Sacramento counties. They report yields of 300 pounds of seed the first year. A yield of 500 pounds was recovered on some second-year stands. The plant lives only two years. Boy, it looks like we kicked over another gold mine. Where, but in California, would you find alfalfa making 600 to 700 pounds of seed to the acre on the first year planting? Yes, they did that down at Wheeler Ridge, Bakersfield. Or take a look at Glenn County where 30,000 pounds of Ladino seed were taken off 80 acres in one year. California has certain inherent advantages in seed growing. This state has a tremendously long growing season. We have controlled growing condi-

tions. We turn off that 'rain' out of the pump or ditch, whenever we want to and thereby enjoy a dry harvest. By the same token we can take the water off the land whenever we want to, to let the crop go to seed. The dry dewless valley is free of some of the diseases that plague the rest of the country. It is for that reason that we grow most of the Nation's bean seed. American vegetable seed stocks are the highest quality in the world. During the war years the U. S. exported 102,000,000 pounds of vegetable seeds to all parts of the world. Most of the big flower seed companies have seed growing fields in California."

Gordon Changes Engines on His "Bass Horn"—In getting at the mechanization of these Pacific Coast soil building seed crops that are bringing tremendous wealth to the scientific farmers with the know-how who have gone into this side of agriculture on a big scale, the writer took a look at all the new machines in the Sacramento Valley just as harvest was ending. Results were known and judgment of the newest machines was fresh and accurate from personal use and contact by men who were keenly aware of the importance of machines that would get the last golden seed from the hay and stubble. Up in Glenn county on a tour of the seed harvest, we encountered two new machines built by Hahn and Mehren of Stockton for Baker Brothers whose fleets of International crawler tractors and GM-powered one-man combines make them big operators. Last year they had gone into Ladino seed on the same scale they go in for anything else, since war days lifted the trio to power and independence. The self-propelled clover combine is a Case thresher set on big air tires with two Hercules engines hung on to propel and thresh. Their vacuum harvester follows the big combine and vacuums the seed from the stubble where it shattered in mowing, raking, and picking up by the first machine. V. E. Gordon's machine was also on the principle of a vacuum cyclone with air blasts to separate seed from straw in the big cyclone after it has been picked up. The writer saw it both as a tractor-drawn and stationary thresher. In other words, Gordon is aiming it at both jobs done by the two machines mentioned as built by Hahn and Mehren for Baker Brothers. His machine was adapted this year to handle this seed, which has become the big crop here. But the gas engine did not satisfy Gordon, who was in charge doing a custom job to study his own creation that was based on the Templeton combine that has slowly developed over the past five years in the central California areas. Gordon went into San Francisco and bought a Buda diesel engine and took it out to his machine to swap it for the gas job he had used on Ladino. The writer saw it on Kenland red clover near Woodland a few days after he changed over. He is now satisfied he has the answer to the power for his revolutionary seed harvester. Next season should tell if the seed harvesters are to all go diesel. But these California seed growers are all diesel crawler farmers and their seedbed, as well as much of their rice harvest, is done by dieselized machines they designed or ordered built in Stockton. They will likely follow with the same efficient power on their seed harvesters from here on if they can get the engines. The questions of steel and rating of agriculture in the emergency will tell the answer.

Ranger alfalfa seed is still more widely scattered. The County Advisor in Fresno county recently tipped the writer that Waldo Weeth had made over a million dollars from his Ranger alfalfa seed farming in the five years he had been growing this crop for seed. A visit to the Wil-Do ranch of Weeth on the edge of the famed Kettleman Hills in the middle of November last found Waldo at home. Weeth is credited by those who have watched his operations the past 20 years as U. S. experiment station manager and farmer as being No. 1 farmer in California in mechanized management and community leadership. He is all diesel in heavy farm jobs. "Now, would you like to see the seed house?" He led the way to a long building back of the row of new cottages for his workers. A key unlocked the warehouse and we saw great stacks of bagged Certified Ranger alfalfa seed, cleaned, sealed and

ready for the Farm Bureau to sell to the seed-hungry farms of the Mid-West, South and East as well as in the West where it was produced. "How much seed have you in this 1950 crop?" the visitor asked. "There is over 500,000 pounds here now, and it is in this bonded warehouse where we can borrow money on it if wanted. Price is 60 cents a pound now."

Seed Production Offers Big Opportunities — "One of the most promising fields for the future expansion of California agriculture is that of growing seed for use in Midwestern and other states," says Frank J. Parsons of the University of California College of Agriculture. Parsons, who is an associate in the Experiment Station on the Davis campus, is retiring president of the International Crop Improvement Association, an organization com-

posed of representatives from the certification agencies of 41 states in the U. S. and provinces of Canada. "The potential demand for such crops as Ranger and Buffalo alfalfa varieties and Kenland Red Clover is enormous — and had been variously estimated at 40 to 60 million pounds each for alfalfa and red clover," Parsons said. "Ladino clover seed is another very important item in interstate commerce."

"The I.C.I.A. is devoted to creating uniformity in standards for certified seed, and the establishment of standards and procedures for interstate certification, particularly the small-seeded legumes and grasses. California's participation in the I.C.I.A. has been especially valuable to state farmers in developing a market and responsible reputation for California certified seed."

Allis-Chalmers HD5 (GM diesel engine) pulling hydraulically controlled scraper leveling land for Ladino clover crop in Oregon.



A doubled-diesel deal: Gordon's grain seed harvester parked at Harlan's and Dumar's ranch southwest of Woodland, Calif., immediately after installation of the Buda diesel engine which may be seen near rear over the air-tired wheel. The outfit is pulled by International MD wheeled tractor owned by Harlan and Dumar whose crops are nearly completely dieselized in both wheel and crawler tractors. This Gordon harvester is waiting here for the morning dew to dry off before starting work.



Supervising & Operating Engineers Section

CONDUCTED BY R. L. GREGORY

Mounting Maintenance Costs Traced to Fuel Oil

DURING the past few weeks, your writer has had innumerable complaints relative to the increasing costs of maintenance on diesel units, particularly the large slow speed units burning the heavier types of fuel. These complaints have not been localized, but have come from Superintendents from various parts of the country as well as from foreign plants. Along with the complaints concerning growing maintenance costs, we have also heard of lowered overall efficiency on many units, and many superintendents have not been able to justify these conditions. Now let me point out that perhaps these two situations are going along hand in hand to some extent, and at present they are conditions which are much more prevalent than we imagine. Not being familiar with many of the plants and plant conditions from which we have had complaints, nor the various conditions under which they are operating, it would be ridiculous for the writer to attempt to give any explanation as to what might be happening in any specific plant or to any particular unit. However, since we too have been faced with some of these unpleasant conditions, perhaps a review of what we have experienced and what we have found out through our investigations, may shed some light on other plant problems.

In the first place there is an evident increase in maintenance costs all along the line. There is the usual price raise in maintenance parts which always appears in a short market. This is primarily due to shortage of materials and increased labor costs. But that is only part of the picture. The balance of the excessive maintenance costs is the result of more frequent maintenance due to abnormal conditions around the plants themselves. Now for an outline of our experience over the past few months.

About eight months ago we noted from our daily plant records, that there was a slow decline in the overall efficiency of our units. This was a condition which has not been normal to our plant operation. The overall efficiency of our units like any other plant has a variation from month to month depending upon conditions of load, conditions of the units etc., but on the whole month in and month out this efficiency has held to a fairly straight average line. Then as previously stated, we noted a continued decline below this mean average for three or four successive months. This

caused us to launch an investigation into all the factors effecting operation, to ascertain whether we could lay a finger on any particular phase that might be at the root of this condition. We had followed our usual practice of making a thorough inspection and overhaul of our units during the spring months, at a time of our lightest load period. During this inspection and overhaul we had checked all the mechanical conditions, including new rings, checked tolerances and settings, timing and fuel injection equipment, made some adjustments and did maintenance to parts which we felt might improve operation. Upon completion of this work we felt that the units were in first class condition and ready to handle the summer and fall loads very efficiently.

Just prior to the holidays, we pulled a few pistons, on a routine checkup, and much to our surprise we noted that there was a small amount of abrasive deposit, similar to the small globules of slag that result in welding operations, upon the piston heads. We also noted that a minor amount of this deposit was present around the nozzles and on the under sides of the cylinder heads. These deposits at that time were not what I would call excessive in quantity but they were foreign to our usual fluffy or sooty carbon, normally present at these points. The ring and liner wear was checked and found to be normal for the elapsed time of operation. The fuel injection systems were checked, as were the nozzle settings and pressures and all in all we could discover no condition from a mechanical standpoint that might be giving us the aforementioned conditions.

We decided to reassemble the unit and watch carefully for further developments, keeping especial notice of the overall efficiency angle. This condition did not improve and the overall efficiency was slowly but surely declining. So at the start of the year we decided to make another inspection and found that there was considerable more of this deposit present. This led us to believe that there had been a decided change in our fuel, and although we always have periodical analysis reports on the fuel, these did not show any apparent change. We could not, however, help but feel that the fuel was the root of the evil, and that something was present in the fuel which was detrimental to our operation. To satisfy ourselves along this line we secured three samples of the fuel we

were receiving and sent these samples to three different sources for analysis. The results were practically the same, but one thing was noted in the results and that was that the carbon residue content was excessively high. Then we took several samples of the abrasive residue removed from the piston heads and sent them in for analysis. We had noted in removing these deposits that they contained considerable copper and tests of our own proved that copper was present. When we received the analysis of this abrasive material it consisted of .80 percent ash and 99.20 percent residue. This residue broken down showed 90.00 percent copper oxide, 4.00 percent iron oxide, 3.57 percent calcium oxide and 1.13 percent miscellaneous materials, all of which was detrimental to the mechanical parts of the units. The question then arose as to the source of this material in the fuel, since we had experienced nothing like it in the previous two and a half years of operation on this same fuel.

We finally traced the trouble to its source. Our fuel vendor had switched to a different type of crude several months previous, and while it had always been their practice to use copper oxide and other treatments in their refining process, this new crude demanded an additional amount of this treatment. Their inventories on diesel fuel had been high enough prior to midsummer, to permit the fuel to stand for periods long enough to allow this treatment to settle out. Then by giving us skimmed fuel from the tops of the tanks, we had not been troubled with this condition. However as the demand for their product grew and inventories got lower, they were forced to give us fuel which contained some of this treatment in suspension, with the result that under compression and firing conditions, it became separated and appeared in our units as solid abrasive materials. We also noted that the exhaust under our normal operating load was becoming very smoky, a condition which we had previously never encountered. So to satisfy ourselves further, that we were confronted with a bad fuel situation, we decided to secure several transports of straight run fuel from another vendor. We did this, but did not dump this fuel in our regular storage tanks, but connected directly to the transports with our transfer pump. We emptied our day tanks in the plant of the old fuel oil and filled them with this new oil. After one day's operation we had the old fuel

... and now please turn to page 68 ...

POWER STATION

**For quiet engine exhausts
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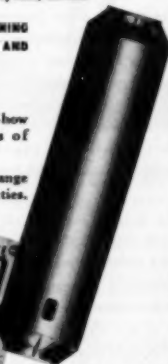
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VALVES

THE article covering "Valve Problems in Diesel Engines" by Vincent Ayers in the December issue of DIESEL PROGRESS was a most excellent one, and, although it reached into some design problems which are somewhat more interesting to the designer than the mechanic, it is an article that is worth reading and re-reading because it has some meat in it that is worth absorbing by operators as well as mechanics who are interested in their diesel engine equipment. It reminded this writer of a recent case of valve failure that was very unusual and the solution was not easily discovered.

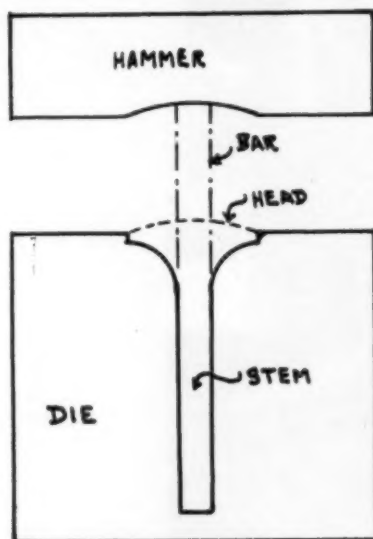


FIG 1

In several of these articles I have pointed out that in making a study of this kind it is imperative to get as many facts as possible and as many examples of failure as can be obtained to see if there is any particular "pattern" to a failure. It can be assumed at the start of an investigation that some failures will always be caused by variations in the material and manufacturing that escape inspection but such failures will not cause any epidemic of trouble and seldom reach the stage where they require special attention, so a pattern must be established before the investigation can proceed.

The case in question was the heads popping off the exhaust valve in an engine which had been in production for a considerable number of years and all of a sudden the failures started to be reported, not from any particular geographical location, nor any particular installation, but from various point and users. The failure could hardly be design or overspeeding because the trouble occurred long after the design had been proven successful and it was not concentrated in automotive installations where overspeeding can occur.

The cams on the camshaft, the valve springs, rocker arms and valve push rods all could, as Mr. Ayers points out in his article, contribute to this trouble but after thoroughly checking each of these items for some change in design, manufacturing and material, nothing was found to be out of order. The solution was found after the valve manufacturer was called in, but even he did not realize what had happened until we went through their records of manufacture and analyzed each order and its processing.

Although from all appearances the valves looked exactly the same and the dimensions were identical for all shipments, it was discovered that the trouble started when he changed his forging method. The valves had been made originally from forgings produced by the "extrusion" method whereas the later valves were made by using the "upset" forging method. This manufacturer uses both methods quite successfully and had changed the process for this valve because of the availability of the one method to meet production requirements. The two different processes are shown in the illustration, Figure 1 and Figure 2.

The upset method shown in Figure 1 uses a rod, of the proper steel for the valve, the size of the stem and the head is formed by successive stages of blows by a hammer on the end of the bar which spreads the material out to the desired shape of the head. The piece is reheated several times before reaching the final shape to permit the metal to flow freely and avoid any cracks or flaws. It may be mentioned at this point that the majority of valves are made this way.

The extruded method shown in Figure 2 uses a slug of metal larger in diameter than the stem but

smaller than the finished head. After being properly heated this slug is placed in the die and a continuous force is exerted on top of it and it causes the slug to "squirt" the material downward through the smaller stem hole of the die to form the stem and at the same time spreads the slug to the shape of the head. This process has the tendency to compress the metal and make the material immediately under the head more condensed and stronger.

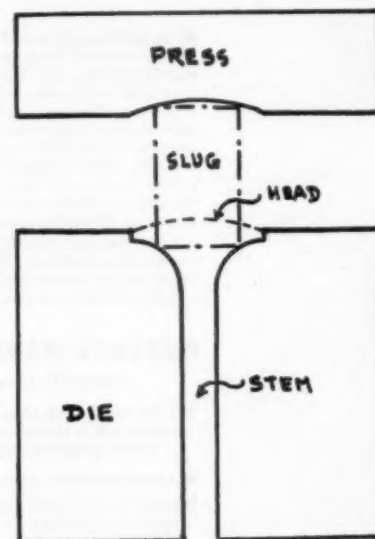


FIG 2

It was apparent as the investigation proceeded that this extra strength was needed in this particular valve because the major difficulty disappeared when replacement valves were made by the extrusion method. The investigation did not stop here because it was evident that there should be some changes made in the valve train that would eliminate the necessity for having a super-strength valve to do the job. A study of the valve train uncovered the fact that a slight change in cam contour would lower the impact which the valve was subject to and this change was made after which the entire trouble disappeared.

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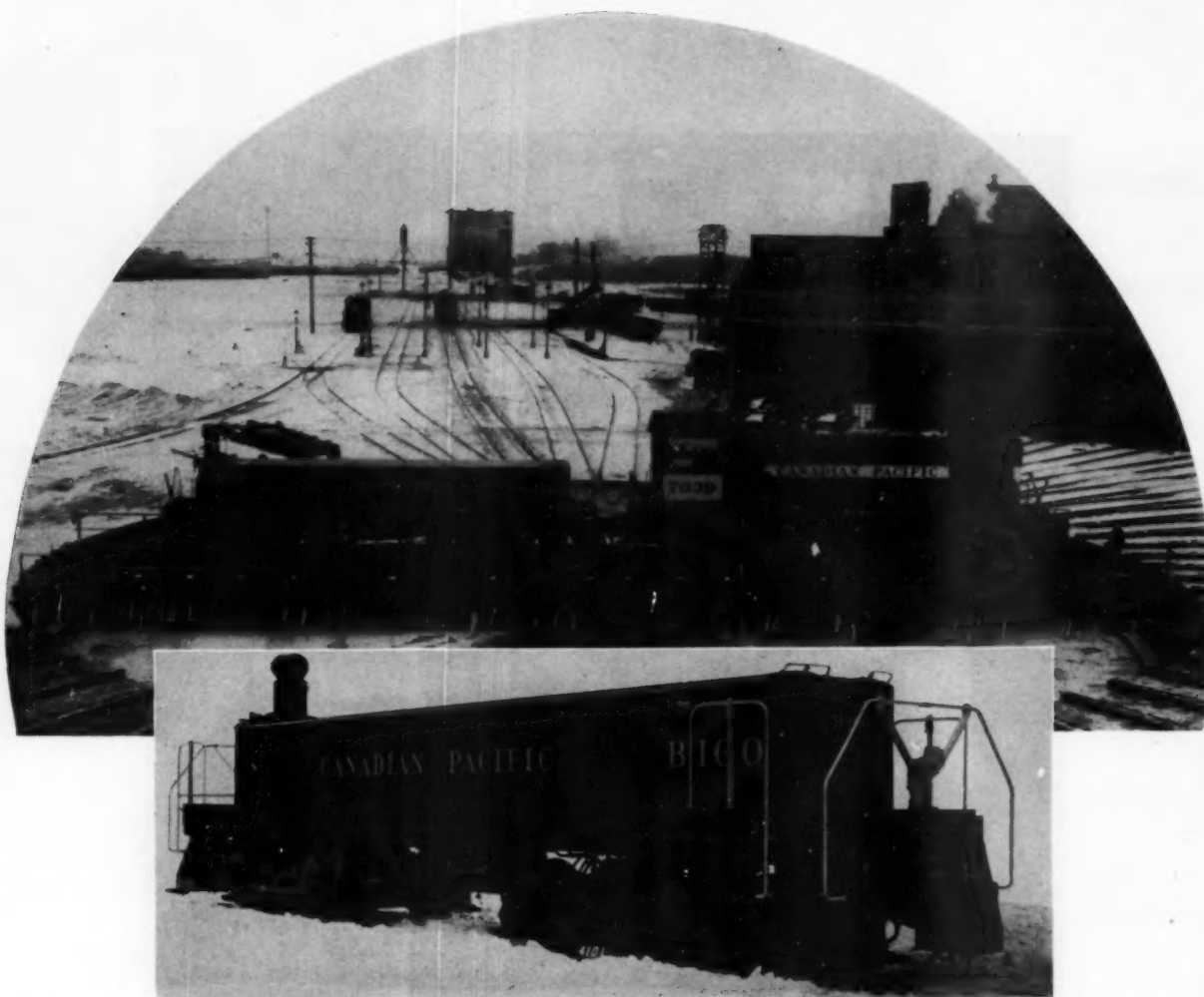
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PARTS...
SERVICE



THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES



WHEN a rider on an old-fashioned merry-go-round caught a brass ring, he earned a free ride. Montreal Locomotive Works, Ltd., recently built for the Canadian Pacific Railway two "brass ring" boosters which will give thousands of free rides to freight cars at the new St. Luc hump retarder freight yard at Montreal. In brief, the new "booster" is an engineless switcher. Permanently coupled to an MLW 1000 hp. standard diesel-electric switcher, it forms a team which at low speeds does the work of two 1000 hp. switchers. But as the booster has no engine, it's something like owning a sturdy work horse with eight powerful legs instead of the regulation four.

The secret, of course, stems from the ability of diesel-electric locomotives to deliver such high tractive effort at the wheel rim. A 1000 hp. diesel switcher can start tremendous strings of loaded freight cars. Motive power engineers knew it could get even more under way if some way could be found to increase starting tractive effort.

The new MLW booster, on current from a 1000 hp. switcher equipped with multiple unit control, doubles the starting tractive effort of a single locomotive. Starting tractive effort of a standard

1000 hp. MLW switcher is 69,000 lbs. at 30% adhesion. Starting tractive effort of the booster is 72,000 lbs. at 30% adhesion. And by adding 5,000 lbs. more ballast, the tractive effort of the switcher also can be boosted to 72,000 lbs. Having no cab, separate controls, or engine, the booster is cheaper to build and cheaper to operate. In short, it's ideal for low-speed shunting jobs such as that at the new St. Luc yard. Or for any "hump" car sorting yard in North America. Only one or two "diesel-less diesels" are in operation south of the border, and each has been a custom-made job. MLW engineers are confident that they could be turned out in Canada for the U. S. market.

The new booster is built on the frame of a standard 1000 hp. switcher and the trucks mount four G.E.-731 traction motors. A shallow steel box mounted on the floor plates of the frame contains: (a) one compartment housing the reverser and other electrical equipment; (b) two compartments, one back and one front, containing the traction motor blowers; and (c) three ballast compartments, containing approximately 52,000 lbs. of steel and poured concrete. Provision is made for drainage and ventilation. The booster is coupled by standard

draft gear to the lead unit. Current for the traction motor blowers comes from an auxiliary generator installed on the footplate of the parent switcher, and there is a switch in the cab by which the operator can place the booster in or out of circuit. Small modifications to the parent switcher were required. The contactor compartment was taken out and rearranged and the cab signal equipment, which duplicated the track-side signals, was relocated. The C.P.R. now has the equivalent of four locomotives for very little more than the cost of three.

To learn what the combination could actually achieve with its total starting tractive effort of 141,000 lbs., the C.P.R. kept records of its January 6 performance. In 44 minutes it put 108 cars weighing 5,169 tons over the "hump", approximately 2 1/4 cars per minute. Moreover, it is available for double duty. Its chief chore at St. Luc is to push long strings of loaded freight cars up the steep receiving track of the "hump", where gravity carries them to one of 40 classification tracks. It is also available for "trimming" duties, however, rearranging cars in the train in which they are to be dispatched.



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WHAT'S GOING ON IN ENGLAND

CONDUCTED BY HAMISH FERGUSON

Hamish Ferguson was appointed Secretary to the Diesel Engine Users Association in London in 1944. Previously senior technical assistant to Diesel and Insurance Consultants, London, and for several years with English Electric Company in the designing and erection of large diesel generating plants. Mr Ferguson continues to do independent consulting work.

GAS TURBINE DEVELOPMENT

GAS turbine development continues to make good progress in England and a number of machines are on order for both industrial and marine use. The industrial type developed by Ruston & Hornsby of Lincoln has proved particularly successful having recently completed an endurance test of just over 1,000 hours on full load. On opening up, the various components were found to be in excellent condition and such minor defects as were apparent were readily traceable to known causes and did not call for any modification in the general design.

The turbo-alternator set runs in parallel with the electricity grid and it was therefore possible to apply a constant continuous load. An important feature when considering the installation of this type of generator for peak-load operation is that it can be started from cold and put on full load within 6 minutes. During the endurance test the turbine was operated on gas oil of the standard grade used for diesels and with this fuel a consumption of 0.59 lbs. per bhp. hr. was achieved, the equivalent thermal efficiency being 23.4 per cent. The efficiency is well maintained at part load and has been found to exceed 18% at half power.

The basic engine consists of a 13-stage axial flow compressor delivering air through a contra-flow tubular type of heat exchanger to twin combustion chambers. The two-stage turbine which follows supplies its entire power output to the compressor, and the exhaust from the compressor-driving turbine then passes through a 2-stage "power" turbine from which the alternator drive is taken through 4 to 1 epicyclic reduction gearing. The exhaust from the power turbine is ducted back to atmosphere. The machine can be operated with or without the heat exchanger. With the heat exchanger the maximum rated output is 1,070 bhp. and without it the output is increased to 1,250 bhp. working with a maximum gas temperature

of 727 deg. C and a compression ratio of 4 to 1. The compressor and its turbine rotate at 11,400 rpm. and the free-running power turbine rotates at 6,000 rpm., the alternator speed being 1,500 rpm. With the exception of the main frame, each of the main assemblies is independent and can be dismantled without interfering with any of the other groups. Flexible couplings have been provided in all the gas ducts so as to ensure that no stresses are transmitted between the various sections of the plant due to relative movement resulting from thermal expansion. Thus the heat exchanger is suspended from four tension bolts, the upper ends of which seat on springs, and each of the gas

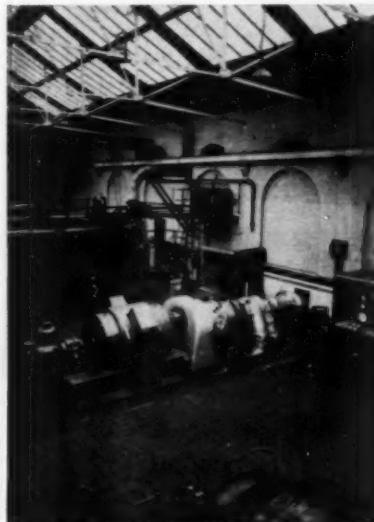
and air pipes leading to the heat exchanger is provided with suitable flexible joints to allow flexing to take place in any direction. The main frame is also used as the oil tank, a feature which leads to compactness and a uniform temperature.

No water is required in any part of the plant for cooling purposes. The turbines are cooled by air bled from suitable points in the compressor while the heat generated in the lubricating oil in the bearings and reduction gear is dissipated in a finned tube type cooler. Starting is accomplished by means of a 15 hp. 24 volt electric starter motor, or by an air motor of equivalent power. Safety devices make provision for the following contingencies: (a) overspeed of compressor-turbine rotor, (b) overspeed of power turbine rotor, (c) failure of lubricating oil pressure. The entire control system is operated by a hydraulic servo system supplied by the main lubricating oil pump. The use of this arrangement makes possible the provision of alternative safety devices such as temperature control and a manual emergency stop.

The fuel and lubricating oil pumps are driven from the same electric motor. The fuel system is capable of operating satisfactorily with fuels of a wide range of viscosity, and the development of a combustion chamber to burn the heaviest grade of residual fuel is now in an advanced stage. A special type of governor has been designed which enables three distinct types of governor response to be obtained from the standard unit as follows: (1) stable governing over the full-load range at a constant speed irrespective of load. (2) stable governing with a "drooping" speed characteristic when the load is increased. (3) "de-tuned" governing suitable for driving an alternator supplying current to a constant frequency "grid" system. The complete plant weight as installed in a power station ready for service is 21 tons 9 cwt., including the alternator.

... Continued on Page 71

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DIESEL ENGINES UNDER THE COMING CONTROLLED MATERIALS PLAN

By PETER B. B. ANDREWS

ACTIVITY of recent weeks in Washington has been extremely vital to the production future of many industries, including diesel engines. During this period, materials requirements under the new, forthcoming Controlled Materials Plan were prepared and are now undergoing intensive analysis.

The data from these studies, plus others, are preliminary to the institution of the Controlled Materials Plan, which is currently scheduled to go into effect July 1, 1951. Naturally, the way the country's production materials will be divided will govern the extent of output in the future. Under this plan, first call on materials will be made for rated uses by claimant agencies, and output will be assigned for these end-uses.

Future orders will be approved upon test of value to defense work or essential civilian uses. In time, priorities for civilian production will appear through the civilian requirements analyses now being studied by a division of the National Production Authority. The civilian requirements branch of the agency will have the status of a "claimant" agency.

The writer has pointed out previously that on the basis of his experience as industrial economic adviser to the War Production Board in World War II, and analyses of the current situation and prospects, it appears that the diesel engine industry should be in a favored position. In his present capacity as an industry consultant to the National Production Authority, the writer reiterates this thought.

Metals requirements figures put in for various industries under the Controlled Materials Plan (and they have been put in for the years 1951 and 1952 by quarters) are confidential and for use only by the various Government emergency agencies.

Generally, however, the military industries showed increased requirements running up to several hundred percent, but many civilian industries also upped requirements over 1950. The figures of metals requirements presented for the diesel engine industry for the current year greatly exceeded the totals consumed in 1950, and, again, for 1952, topped those for 1951.

Reasons behind this stepping up of requirements for the diesel engine industry are weighty. The diesel industry fundamentally is a war industry. Diesel engines are a necessity in practically every facet of the mobilization program, as attested by the fact of the huge order backlog on manufacturers' books. Importantly, the diesel industry places great production impetus behind such vital

industries as railroads, trucking and other transportation, farming, construction, shipping, petroleum production, logging, road building, basic industrial power, mining, irrigation, quarrying, and central and municipal utility plants.

These are the principal bases on which larger requirements for materials in 1951 and 1952 have been claimed, and they will be considered by Government program-planning men who will be cutting up the Controlled Materials Plan pie and serving a slice to the diesel engine industry. While the requirements thus have been presented, both for materials needed for protection and for materials needed for maintenance, repair and operating supplies, (M.R.O. in Government tabs) there is no assurance that the diesel engine industry will be given all the materials for which it shows requirements.

The C.M.P. pie, with all the metals and materials of the country in it, is now being cooked, and when, in the weeks ahead, it comes to deciding who gets what slice (out of the hundred or more claimants for a piece), the writer can say with the utmost assurance that many will not get the size cut shown as requirements. There simply won't be enough pie to go around, and somebody's going to go hungry.

Many industries will be cut down on the requirements presented; in fact, the writer believes that the majority of industries under the C.M.P. will not get the full amount of materials requested. Virtually all civilian industries will fall in this category. Essentiality will be the keynote and will guide the decisions of the Industry Operations Bureau of the National Production Authority in Washington.

In the writer's considered estimation, the diesel engine industry is a highly essential one and needs more materials for adequate satisfaction of orders. It is quite possible, however, that the writer's opinion may not be shared by some programming men in Washington. Supporting this thought is the fact that the diesel engine industry does not have many DO (defense orders) as yet, but these are rapidly rising. However, many orders for diesel engines now classified as civilian could be analytically proved, the writer believes, to be just as essential to the mobilization program as a direct DO. Before the C.M.P. pie is cut, it will very likely be necessary to emphasize this basic essentiality, increasing the Government planning board's comprehension of the vital part which diesel engines occupy in the over-all picture.

Significant, too, is the Government's expectation of basic growth in the American economy in the next two years and the need of planning for it.

The writer believes that it is conservative to expect the nation's gross national product under the stimulus of armament production to expand at least 7% in 1951 over 1950, with another increase in 1952 likely over 1951. The diesel engine industry always moves along with the basic economy, and since the Government planners are looking for further expansion in economic activity during the next two years, it is also logical to expect that materials usage by the diesel engine industry will be on the rise. However, if any sacrifices should be necessary for this industry, the writer believes it will cooperate fully—as it always has in the past—and that it will show typical American ingenuity by operating at a high, efficient rate in the face of adversities.

Institution of the Controlled Materials Plan should be welcomed by the diesel industry for, as matters stand now, this industry is not getting all the materials it needs, despite its importance to the basic conduct and efficiency of the nation's productive system.

Any production slowdown due to lack of supplies is harmful to the diesel engine industry in ways besides curtailing the flow of its fundamentally essential products. Thus, it is likely that skilled manpower would be lost because of sporadic production slowdowns. War-material industries are now beating the bushes and constantly seeking workers of these skills.

Procedures used in estimating materials requirements of the diesel engine industry are of considerable significance. In Washington, the people computing materials requirements under the Controlled Materials Plan were informed that it is desirable to obtain the materials requirements by the use of a bill of materials. A bill of materials describes, for a given time, the basic materials and components which the producer of the end item must use in order to produce one or a given number of units of the end item.

The materials include any wastage on the part of the producer of the end-item products, scrap developed in processing, and rejections of material during processing. Generally, the computers in the requirements had considerable difficulty fitting in the requirements on the Government forms, which had rather complicated breakdown classifications.

The bill of materials system, however, was not used in the case of the diesel engine industry. Previous experience had indicated that in many cases—such as in the diesel industry—it is neither feasible nor appropriate to develop material requirements by use of the bill of materials. Historical studies of material usage in a significant volume of production may provide a basis for such calculations.

Urgency of getting in the materials requirements figures required taking short cuts in some cases. In some products the most reliable quick approach to material usage was found to be through correlation of the use of one material with another material in homogenous groups of items. In other products, the most appropriate way of determining requirements for one material was to study data on requirements for a related material.

In calculating materials requirements for the diesel engine industry, the Government programming men necessarily used adequate lead time factors. Lead time represents the number of months from the date when materials are shipped by the supplier to date of completion of the end item in which they are incorporated. In using the lead time factor, it was assumed that materials would be shipped on schedule and no allowance would be made for inventory accumulation.

Though rather hastily computed, the materials requirements figures for the diesel engine industry under the Controlled Materials Plan were put together as painstakingly as the pressure permitted, and they have taken into consideration all the likely needs of the civilian and war economy.

As far as materials used in conducting operations are concerned (maintenance, repair and operating supplies, abbreviated to MRO by Government analysts), these have been possible to procure regularly under the National Production Authority's MRO Order (NPA Reg. 4) designed to allow all business firms to obtain these operating supplies.

These, of course, are just operating supplies and do not include production materials that are processed into the end product. Purchasers are allowed to attach a priority rating to purchase orders for MRO materials. This rating is identified as DO-97, and is equal to all other DO ratings. While this might offhand appear satisfactory, actually it is not—at least for the busy diesel industry. Thus, the quota for each concern is the amount of dollars spent for MRO materials in 1950, not quantities of these materials. With 1951 prices far higher than in 1950, the inevitable result is to reduce the quantity of MRO supplies that can be purchased. Another drawback is that if a concern elects to use a DO-97, even for single purchases of a single material, this concern must then limit its total MRO purchases to the dollar quota of MRO orders in 1950. Practical result is that inevitably at least one material cannot be obtained without using a priority, and therefore all MRO purchases must be restricted in accordance with the regulation.

National Production Authority officials now are considering an easing of the MRO regulation, and if the amendments now under study are adopted, it may be feasible for diesel engine producers who have avoided use of the MRO order to come within its provisions. It is proposed that the MRO quota be raised to 120% of base-period expenditures. This appears to be a highly sensible proposal, and its adoption would at least partially compensate for the price increases since 1950.

Another proposed change would allow a business to use the MRO order to obtain a single type of

material without being forced to limit all MRO purchases to dollar outlays of the base period.

The writer again points out that Regulation 4 applies only to operating materials and not the raw materials going into production of the end product, which in this case, of course, is the diesel engine. These production materials will be distributed under the Controlled Materials Plan, and at least the diesel engine industry is off to an excellent start in the presentation of favorable totals of materials requirements. However, every opportunity to emphasize the industry's essentiality must be taken; otherwise, in the ultimate allocation the industry may not receive all the materials it merits for its contribution to a successful defense economy.

Switching Locomotives Ordered

The Canadian National Railways has placed an order for 24 switching locomotives costing approximately \$2,500,000. Twelve of these diesel-electric locomotives will be built by General Motors Diesel, Ltd., at London, Ontario. They will be of 800 horsepower. The others, of 660 horsepower, will be built by Montreal Locomotive Works. The new diesels will bring the number of such locomotives on the Canadian National to 289 units.

DIESEL ENGINE CATALOG is now available in its Fifteenth Edition. Completely revised and up-to-date, it is invaluable to design engineers and buyers. **ORDER COUPON ON PAGE 26.**



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Supervising

... continued from page 38 ...

practically all out of the system and started the use of the new fuel. The units immediately responded to the change and practically all traces of smoky exhaust disappeared even on heavier loads than we had normally carried before. This definitely proved that the cause of our trouble was fuel oil primarily.

However our overall efficiency did not return back to normal, so we launched a further investigation into our fuel injection system. First we removed some of the fuel pumps and found that instead of the usual .000040 of an inch tolerance between the plunger and barrel that we had several times

that amount and that the plungers and barrels were badly worn. We also found that the delivery valves had become badly worn during the past few weeks operation and that the holes in the injection nozzles were worn. A check on the liner wear also proved that there had been as much wear on the liners in the last eight months as we had experienced in the past two and a half years. All these conditions led to a drop in the overall efficiency. It further meant that in order to get the units back on the original overall efficiency basis that we were compelled to go over all our fuel pumps, delivery valves and nozzles and put them in shape or install new ones. This meant a big jump in maintenance costs, since this equipment, had it not been for faulty fuel should have lasted for many months

without additional replacement parts. While the liner wear was excessive it did not mean replacement of the liners at once, but the normal life of these liners was naturally reduced and they eventually will have to be replaced before the normal required operating life is reached.

The foregoing case history might be typical of other plants who are finding their maintenance costs rising, but it has been given with the view of what can happen with changing fuel conditions. Under present economic conditions anything can happen. Our readers may recall that several months ago your writer stated in an article, "Fuel conditions will become worse before they become better."

One cannot fully blame the fuel vendors for this situation, due to the fact that the end point of most refineries today is the production of high octane gas, naphtha, etc., all of which has a much higher market value than the residue fuels which we use. They are attempting to give satisfactory service to all customers and in many instances may be caught behind the eight ball in this policy. The result is that we of the diesel industry will get what is left and in so doing we will suffer in the long run as far as efficiency and maintenance costs are concerned. Just what the answer should be is difficult to say, but to the writer some points are quite obvious. First, the vendor should cooperate with the diesel operators to the extent, that if methods in refining or deliveries are necessary, he should advise the user of these fuels that these conditions exist, so that the operator can be forewarned of changes and govern himself accordingly. Secondly, every Supervisor should have frequent analysis of his fuel made in order to convince himself that the fuel he is getting is not detrimental to his units. Thirdly, there should be absolute cooperation between the fuel vendor and user on this matter of diesel fuels.

Diesel Generator Sets

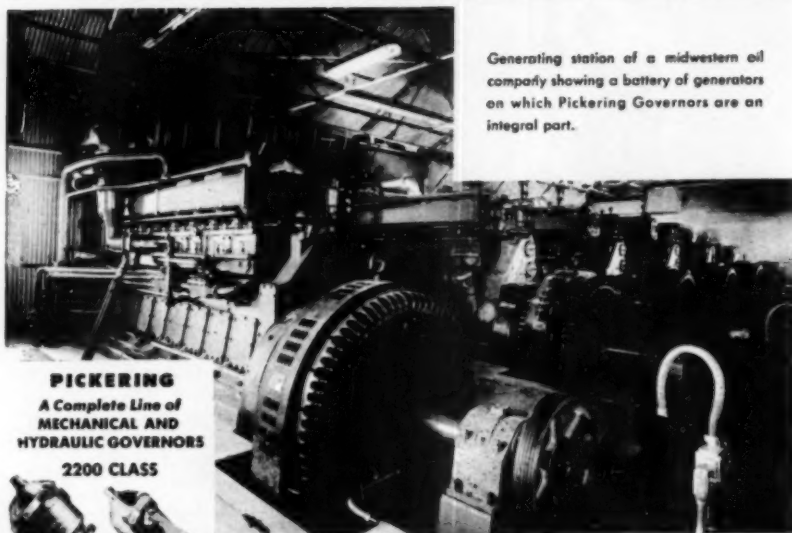
The Kato Engineering Company of Mankato, Minn. recently announced a new range of small diesel belt driven generator sets from 2½ to 10 kva. Kato has adopted the Petter AV and a B type diesel engines throughout. The 5 kva. 115/230 volt single phase 60-cycle set is powered by a Petter AV2 two-cylinder engine which has a displacement of 67.6 cubic inches and develops 10 hp. at 1500 rpm. or 12 hp. at 1800 rpm. (continuous duty ratings). One interesting feature is that the 2½ and 5 kva. sets can be powered either by a water-cooled or air-cooled diesel. The high fuel economy of the Petter diesels enables power to be generated for as low as \$1.25 per kw. hours, based on a fuel price of 13¢ per gallon. The engine is easily started manually, however, electric starting is available. Illustrated above is the 5 kva. ac. Kato generator set powered by the Petter AV2 diesel.



DIESEL ENGINE CATALOG is now available in its Fifteenth Edition. Completely revised and up-to-date, it is invaluable to design engineers and buyers. ORDER COUPON ON PAGE 26.

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Synonym for dependability since 1862



Generating station of a midwestern oil company showing a battery of generators on which Pickering Governors are an integral part.

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For 89 years, Pickering Governors have met and anticipated the needs of American Industry. They have more than established a reputation for fully-dependable, long-term service under every type of operating condition.

Today, Pickering stands ready to supply the right governor for the job — to supply the governor that will maintain operating efficiency at its peak regardless of service conditions.

To consult Pickering Engineers may be your passport toward more efficient and economical operation of diesel equipment.



THE PICKERING GOVERNOR CO.

Established 1862

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BREAKDOWN

need not be prolonged!

Any part can be duplicated from the worn-out or damaged one, or from a drawing. Or when it is not practical to ship us the old part and drawings are not available, our Engineers will visit the location to prepare drawings and discuss repair procedures, when justifiable.

For example, a crankshaft in a custom built pump recently broke in service. Delivery of a new shaft from the factory was expressed in terms of MONTHS!

The broken shaft was received in our shops on MONDAY—drawings were prepared, and a completely new crankshaft—accurately machined from a solid forging was ready for delivery the following SATURDAY!

MONTHS of costly shutdown reduced to SIX DAYS!

Failure of Obsolete Parts and "Out of Stock" items need not delay your operation!

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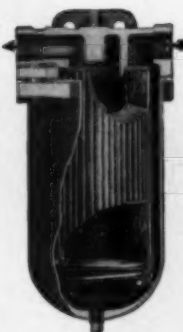
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Name in Filtering

Nine times out of ten **Bendix-Skinner** Filters will supply the "finest" answer to your filtration problems. Here are the facts: available with patented, exclusive, resin impregnated cellulose elements; simple, quick replacement; high flow rate with minimum pressure loss; no channeling or bypassing; over 350 models providing filtration from 1/2 micron (.000019") upwards at flow rates from 1 to 5000 g.p.m. Why not let **Bendix-Skinner** filtration engineers work with you? Write us direct.



Model 3710-P filter element, 6 1/2" x 8 1/2", has a filtering area of 940 sq. in.



SKINNER PURIFIERS DIVISION OF

1503 TROMBLY AVENUE
DETROIT 11, MICHIGAN

Export Sales: Bendix International Division, 72 Fifth Ave., N.Y. 11, N.Y.



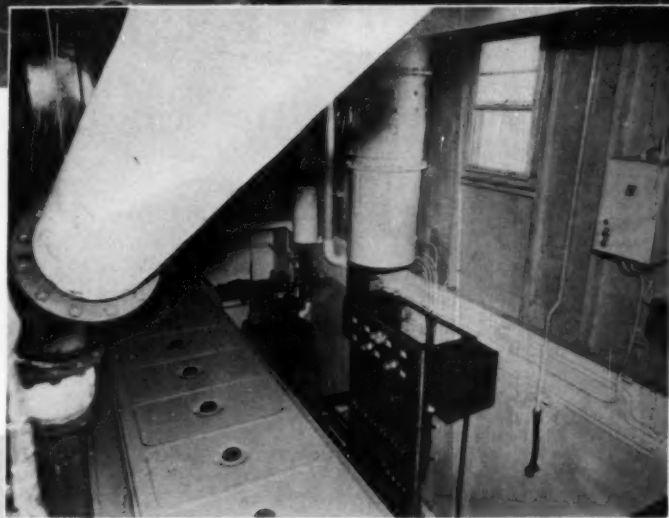
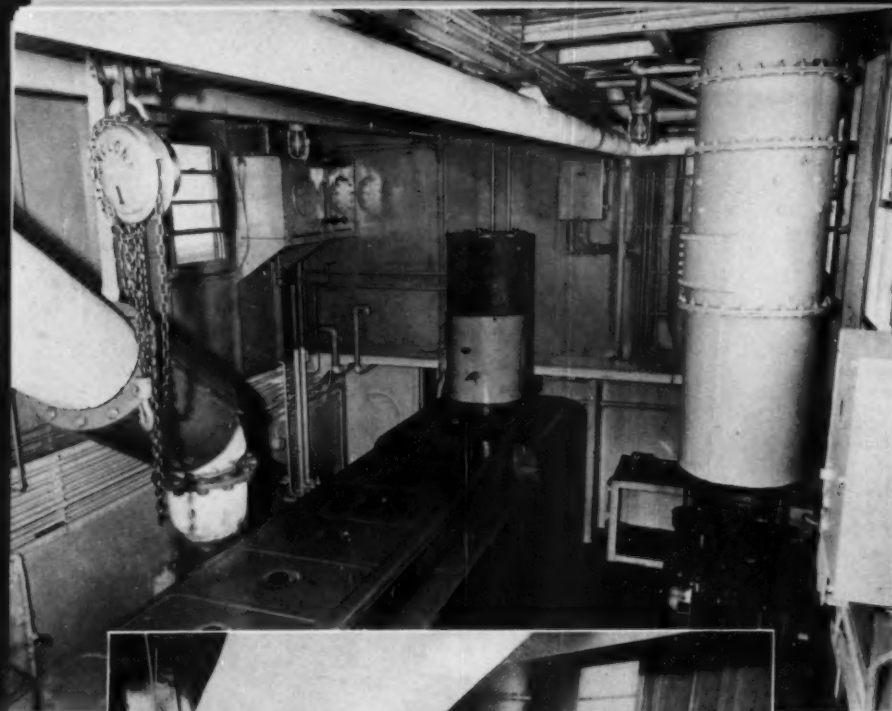
"EDDIE E"

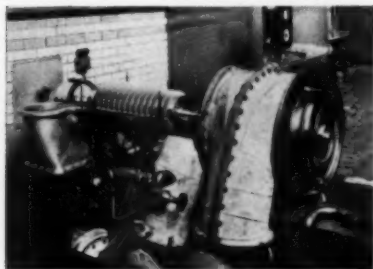
ANOTHER name has been added to the long list of boats designed and built by the St. Louis Shipbuilding & Steel Co. for Igert, Inc., Paducah, Kentucky. This name will probably become better known on the rivers than some of the previous vessels because in actual river tests it proved to be one of the best pushers per horsepower ever tested. The *Eddie E* was christened at Paducah, Kentucky, on September 8, 1950, and will be operated by Igert, Inc., on the Tennessee, Ohio, and Mississippi Rivers. The hull of the *Eddie E* is 74 feet by 20 feet by 9 feet, with a normal draft of 6 feet 6 inches. The bow is a St. Louis Ship modified scow type, and the stern is tunneled for the single screw. A Kort nozzle and Contraguide steering rudder contribute much to the superior performance of this boat. The hull is of heavy rugged construction with three-eighths inch plate in the shell and five-sixteenths inch for the bulkheads.

Quarters are provided for a crew of eight in the steel deckhouse, with two baths, galley and mess. All quarters are lined with masonite, tastefully painted, and insulated with two inches of Fiberglas. The pilot house is of the same construction with electrical circuits provided for radio and radar and a roof sufficiently strong to permit mounting a radar unit. All windows except the pilothouse front and back have Truscon steel sash. The galley is equipped with a No. 1100 Shipmate oil burning range a 21 cu. ft. electric refrigerator as well as a double bowl stainless steel sink, meeting requirements of the U. S. Public Health Service, and ample storage cupboards and cabinets. In addition to the Contraguide steering rudder, the boat has two backing rudders with all rudders controlled by a St. Louis Ship electro-hydraulic steering system with electric follow-up controls.

The main propulsion unit is an 8-cylinder, $8\frac{1}{2}$ by $11\frac{1}{2}$ Fairbanks-Morse model 31A, 2-cycle, direct reversible, with 2:1 reduction gear, marine diesel engine, rated 440 hp. at 525 rpm. This engine turns a solid, cast steel, 4-blade, 66-inch diameter St. Louis Ship propeller, and is arranged for pilothouse operation. Main engine cooling is with a St. Louis Ship closed clear water skin cooling system. Two fuel oil tanks with a capacity of 10,800 gallons are built in the hull, while a 150-gallon lube oil storage tank and a 1,500-gallon fresh water tank are located in the hull. Sanitary water is drawn from a sea chest.

A 5-kw., 125-volt, d.c. generator is driven off the tailshaft by V-belts while auxiliary power is furnished by a 10-kw., 125-volt d.c. generator, driven by a U. S. Motor diesel engine. An Exide 56-cell, 112-volt, 150-amp.hr. storage battery floats on the line. A Kahlenberg air horn is mounted on the pilothouse roof. Exhaust fans are provided in the engine room and galley. Two Beebe all-steel 5-ton hand winches, together with ample deck fittings, make the *Eddie E* one of the finest small boats operating on the rivers today.





Gas generator unit with compressor and turbine half-casings removed.

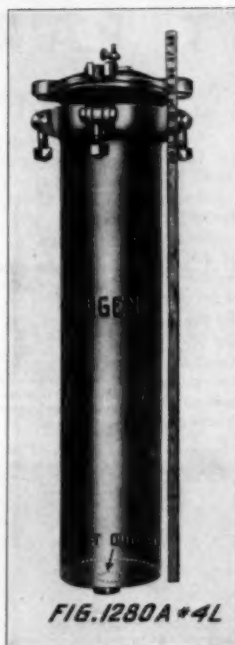
Owing to the way in which the main components of the plant naturally break down into the main assemblies of: rotating components (compressor-turbine assembly, power turbine and reduction gear), main frame, and heat exchanger, the plant can, with very little modification, be adapted to fulfill many different kinds of duty.

For portability the heat exchanger may be arranged alongside the rotating components instead of underneath them so that the complete plant may be mounted on a flat concrete floor, or alternatively the heat exchanger may be omitted entirely if either there is lack of space or the plant is intended for power generation in an emergency. If required the heat exchanger may be added after the plant has been in operation for some time. It is not necessary to provide strong and elaborate foundations for the plant, as is the case with an oil engine, owing to the absence of vibration. For ship propulsion a heat exchanger will usually be required, and this can be disposed with the tubes vertical, the upper part of the heat exchanger occupying the lower part of the funnel. Power may be transmitted to the screw through a reverse-reduction oil-operated gearbox.

Exhaust gas inlet end of heat exchanger showing tube bundles in place and headers ready for assembly.



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Write today for descriptive literature outlining the nature of your filtering problems. It's the first important step towards big savings.

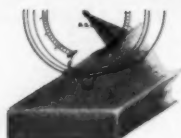


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1897

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fits and finishes that guarantee fine performance.

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Canadian Representatives: Jos. Robb & Co., Ltd., 4050 Namur St., Montreal 16, P.Q.

HERE IS A PRACTICAL GUIDE for the user of iron and steel castings . . . 24 pages of technical data on many types of metals and alloys. Write for your free copy.



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Mack Trucks: Empire State Bldg., New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

Mack trucks powered by Mack-built diesel engines bring to ever-growing numbers of truck owners the double savings of more miles per gallon at less cost per gallon. These five diesel-powered Macks were recently installed by Kelleher Motor Freight Lines, Inc. of St. Louis, Mo.





DIESEL SHIP "CLAUDE TULLY"

By DOUGLAS SHEARING

THE DIESEL ship *Claude Tully*, a 3200 hp. screw towboat, was the sixth river towboat designed and built in 1950 by the St. Louis Shipbuilding & Steel Co., and is the first of a number of towboats of this same size which will be built in 1951. Designed and built for the Patton-Tully Transportation Co., the *Claude Tully* hull is 150 foot long, 35 foot beam, and 10 foot deep, with a normal draft of 7-foot-0, and a maximum draft of 7-foot 6 inch when fully loaded with 21 days supply of fuel, drinking water and wash water.

The hull of the *Claude Tully* is almost a duplicate of the *Sohio Cleveland* (now *Valvoline*), which was built by St. Louis Ship in 1949, and like that towboat, the *Claude Tully* will push three 290 foot x 50 foot barges, and with this tow is expected to make over 12 miles per hour.

Built to American Bureau of Shipping requirements, the *Claude Tully* is of all-welded steel construction with an exceedingly heavy hull. Bottom and side plating is $\frac{3}{4}$ inch, bilge strakes and tunnel plates are $\frac{1}{2}$ inch. Deck plating is 7/16 and 5/16.

Framing is both longitudinal and transverse with $\frac{3}{4}$ inch bulkheads stiffened vertically and transversely. Tunnels are well rounded, and the bow is a St. Louis Ship model scow bow with easy flowing waterlines. By locating the main engines and auxiliaries well to the stern, all quarters, galley and mess are forward of the engine room where they are isolated from engine noises. Five large state-rooms are located on the main deck for two cooks and 8 crew members, with 2 bathrooms. A large galley and separate mess room just forward of the engine room, together with a crew's lounge, complete the main deckhouse arrangement. All quarters, engine-room and pilothouse, can be reached by stairs and passages located inside, which is an advantage in inclement weather. The second deck contains quarters for 2 engineers, 2 pilots, and the captain, as well as a bath. A guest room with private bath and an officers' lounge are also on this deck. All quarters, pilothouse, mess and galley are lined with $\frac{1}{4}$ inch Masonite and exposed walls and ceilings insulated with 2 inches of Fiberglas. Inside partitions are of Masonite, except the forward and after ends of the engine room are 3/16 inch steel

with suitable stiffeners, and insulated with 2 inch of Fiberglas. All outside doors are of weathertight steel construction, while inside doors are wood. All windows except forward pilothouse sash, are Truscon steel sash, and door and windows are complete with screens. Armstrong cork asphalt tile is used in all the quarters, passages, pilothouse, galley and mess. The forward pilothouse sash are of special St. Louis Ship design.

The galley and mess room are extremely large and well arranged with ample cupboard space in both for storage. The galley has an electric stove, a large refrigerator, a separate deepfreeze, and a stainless steel sink meeting U. S. Public Health Service requirements. Work surfaces and serving counters are also provided.

The *Claude Tully* is powered with a pair of Fairbanks-Morse model 38 10-cylinder opposed piston diesel engines, each developing 1600 hp. at 720 rpm., and with the Farrel-Birmingham reduction gears, turn the propellers at 288 rpm. The engines can be controlled from either the engine-room or

the pilothouse. The controls are of the hydraulic type adapted for the Fairbanks-Morse engines by St. Louis Ship engineers. The cooling of the main and auxiliary engines is accomplished by a St. Louis Ship skin cooling system controlled by automatic temperature regulating valves. The electric power for the boat is provided by two General Motors model 3-268A diesel generating sets, each capable of delivering 100 kw. of 440 volt, 3 phase, 60 cycle power, and also 20 kw. of 115 volt d.c. power. The generating sets and the main switchboard are located on the main deck at the aft end of the engine room.

The motor driven Gardner-Denver air compressor air tanks, potable water and wash water sets, Worthington fire pump and fuel oil transfer pumps, are all located in hull compartments forward of the engine-room. The motor driven circulating water pumps are located in the lower engine-room, and the Ross lube oil coolers and Puro-lator lube oil filters are in the upper engine-room near the forward bulkhead.

The boat is equipped with 4 backing rudders (2 forward of each propeller) and 2 Contraguide steering rudders. The steering rudders and backing rudders are controlled separately, and the system is the St. Louis Ship electro-hydraulic type with follow-up controls. The steering gear, including pumps, motors, controls and cylinder, is located on the main deck aft of the engine-room. All engines and machinery are readily accessible and the layout of machinery makes the engine-room one of the most efficient and spacious of any towboat on the rivers today.

Filtered air for the main engine blowers is taken from separate air intakes on the Texas deck. The engine-room and hull compartments are ventilated by motor driven blowers located on the Texas deck with ducts leading to the machinery room and lower engine-room. The galley is equipped with an electric exhaust fan.



Consulting Engineer Retires

A brochure pertaining to the retirement of Mr. R. E. McDonnell of Burns & McDonnell Engineering Company, consulting engineers of Kansas City, Missouri, has been issued. The effective date of Mr. McDonnell's retirement was April 2nd. At that time he completed fifty-three years outstanding engineering service with the organization of which he was the co-founder in 1898. In its many years of engineering service, his firm has designed and built



R. E. McDonnell

projects which are scattered over forty-five states and also in Alaska, Canada and Mexico. The brochure commemorating his retirement outlines the history of the company.

More Diesels for New York Central

The New York Central Railroad has announced the largest locomotive order in its history: 387 units of new diesel-electric motive power at a cost of approximately \$64 million. The locomotive order, divided among four manufacturers, is believed to be the largest ever placed by any railroad. It consists of 270 road freight units, 30 road passenger units, 54 road switchers and 33 yard switchers. Delivery of the new locomotives, which

will make the New York Central even better prepared to carry out its transportation responsibilities in the national emergency, is expected to begin in May and be completed during the second quarter of 1952. They will increase the diesel-electric ownership by the railroad and its affiliates to 1,642 units with a total of 2,091,100 horsepower.

The locomotives will be constructed by the Electro-Motive Division of General Motors Corporation, the American Locomotive Company, Fairbanks, Morse & Co., and the Baldwin-Lima-Hamilton Corporation. Orders placed with each of the manufacturers are—Electro-Motive Division: One hundred thirty-one 1,500 hp. road freight 'A' units, seven 1,500 hp. road freight 'B' units, twenty-two 2,250 hp. road passenger 'A' units, twenty-seven 1,500 hp. road switchers, eleven 1,200 hp. yard switchers, six 800 hp. yard switchers. American Locomotive Co.: sixty-two 1,600 hp. road freight 'A' units, thirty-two 1,600 hp. road freight 'B' units, twenty-seven 1,600 hp. road switchers, thirteen 600 hp. yard switchers. Fairbanks, Morse & Co.: eight 2,400 hp. road passengers 'A' units, eight 1,600 hp. road freight 'A' units, four 1,600 road freight 'B' units. Baldwin-Lima-Hamilton Corp.: eighteen 1,600 hp. road freight 'A' units, eight 1,600 hp. road freight 'B' units, three 1,200 hp. yard switching locomotives.

Civil Defense Guide

The Leece-Neville Company has published a booklet entitled "A Guide to Mobile Communications for Civil Defense." This booklet gives information on how mobile two-way radio serves to help coordinate all operating services into an efficient team. The guide can be obtained free by civil defense and government officials or others concerned by addressing the Leece-Neville Company, Cleveland 14, Ohio. During an emergency, it is imperative that constant communication be maintained between local civil defense control centers and mobile services. The one sure method of continuous communication is two-way mobile radio. With this self-contained and self-powered system, the civil defense director has complete control of all services: the chief warden, police, rescue, fire department, medical and taxi. He need not rely on inflexible wire services which may become damaged or jammed with calls by private citizens.

Acquires Synchro-Master Company

%Proportioners, Inc.%, well-known Providence, R.I. manufacturer of chemical proportioning and feeding equipment, has acquired Synchro-Master Company, formerly of Seneca Falls, N.Y., and will operate the business as its Synchro-Master Division with sales and production facilities located in Providence, R.I. The key personnel of the Synchro-Master Company has also joined %Proportioners% and will manage the new division. The merger makes available to Synchro-Master the manufacturing facilities and financial backing of a large well-established company. Synchro-Master units will continue to be produced for the marine field as in the past and new applications are planned for other fields.

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**UNSURPASSED
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Today's modern UNION Diesel products* incorporate and pioneer improvements which assure unsurpassed dependability for your —
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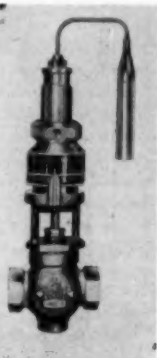
Expands Production Facilities



The Lubaid Division of Zecol-Lubaid Co., manufacturers of fuel additives, has moved into a newly constructed factory building in Milwaukee, Wisconsin. Both general offices and factory are located in the same building. The arrangement of the new quarters has speeded up both shipping and manufacture. Mrs. Leo J. Sauerborn, Zecol-Lubaid president, stated that additional railroad sidings, increased truck loading facilities, and the addition of new improved equipment has more than doubled previous production. The company manufactures Lubaid-D, a fuel oil additive for diesel fuel that aids in achieving cleaner over-all combustion; Liquid Sootout, for the dispersion of condensation and sludge-forming elements for thermo plants in industrial and marine fields, and Lubaid Tankwash, a concentrated cleaning agent designed to atomize with steam application as well as for direct surface use to emulsify sludge and oil residues.

New Calibrated Dial

A new calibrated dial for use with Leslie Class T and Class M type temperature regulators has been announced by the Leslie Co., 175 Delafield Ave., Lyndhurst, New Jersey, manufacturers of reducing valves, pressure and temperature controllers, strainers and Leslie-Tyfon air horns and steam whistles. The dial embodies several new features which assure quick, easy and dependable temperature settings. It is time saving in that a quick turn

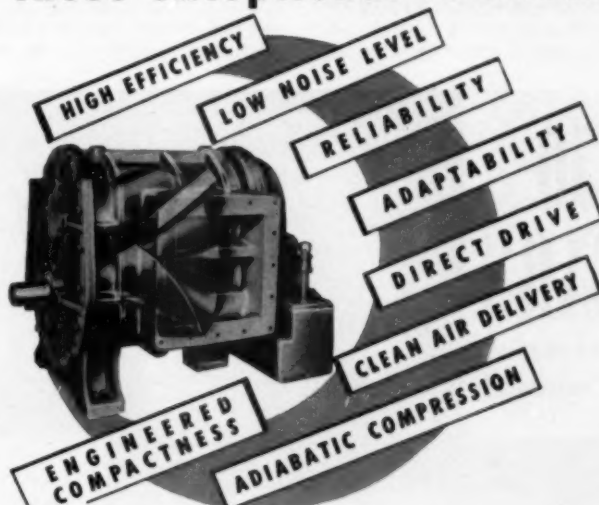


of the dial to the desired setting is all the attention that is necessary. There is no need to wait for the equipment to heat up to find out if the setting is correct. The calibrated dial is also said to provide protection against overheating caused by guess setting. It is designed for long life under rugged operating conditions such as production line use where frequent readjustments are necessary for process work. The dial fits in place of standard adjusting sleeve and are easily installed on Class T and Class M type regulators already in service.

DIESEL ENGINE CATALOG is now available in its Fifteenth Edition. Completely revised and up-to-date, it is invaluable to design engineers and buyers. ORDER COUPON ON PAGE 26.

MAY 1951

The STANDARDAIRE BLOWER offers these exceptional features



WHETHER you require 20 cfm or 15,000 cfm capacity blowers these features are inherent in the unique design of the modern Standardaire positive displacement blower. Its epicycloidal rotor form acting as an air screw is unlike that used in the conventional lobe type unit—and Standardaire blowers have demonstrated their all-around superior performance to the satisfaction of many leading industrial users.

Send today for complete information. If you have specific requirements our engineers will welcome the opportunity to work with you. Write Dept. E43 The Standard Stoker Company, Inc., 370 Lexington Avenue, New York 17, N. Y.



Do you have the 1951 STANDARDAIRE Selection Chart?

THE STANDARD STOKER CO., INC.

Standard Stoker



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Muffler Types Described

The Fluor Corporation, Ltd. of Los Angeles, California, has issued a colorful bulletin which gives technical information on their air-cooled and non-air-cooled muffler and muffler systems. Two types are described: the Series "T" single-element muffler and the Series "D" dual-element muffler system. The former, available in two standard models, is designed on the principle of an acoustical low-pass filter which "strips" out the audio components of sound waves being transmitted through exhaust gases. The Series "D" design, also available in two standard models, consists of an acoustical low-pass filter which incorporates a "phase shifting" principle that "smooths" out pulsative waves by

means of a primary reflection chamber located in the immediate proximity of the engine. The resultant frequency in both muffler types is near the low audio range of the human ear, eliminating the nuisance and psychological problems associated with the operation of internal combustion engines such as mechanical resonance in windows, panels, building walls and objects far removed from the muffler discharge. The Series "D" is designed particularly for use with 2-cycle diesels of crankcase scavenging type. The Series "T" is recommended by the manufacturer for installation on 4-cycle internal combustion engines.

Schematic drawings, engineering specifications and tables giving application data for several engines

are included in the bulletin. A valuable addition to a technical reference library, the bulletin is available from The Fluor Corporation, Ltd., 2500 South Atlantic Blvd., Los Angeles 22, California. Ask for Bulletin No. FM-8501.

Rehabilitated Towboat

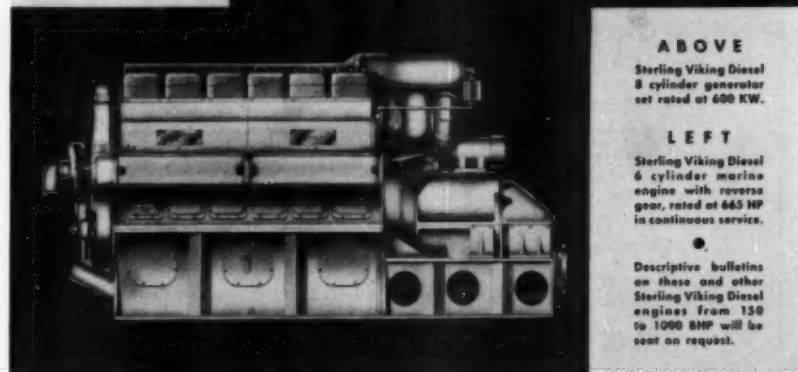


When the M/V *Meriwether Lewis*, of the Commercial Petroleum & Transport Co., sank in the Mississippi River at Thompson's Bend on October 20, 1950, after striking a submerged object, the progress of its raising was a matter of interest and daily inquiry. After the sinking, the boat continued to sink into the soft river bottom until only about one-half of the pilot house remained above water. Countless man-hours and unlimited quantities of equipment were used before the *Lewis* was raised in November, 1950. Suspended between two empty tank barges, the *Lewis* was towed to the St. Louis Shipbuilding & Steel Co., of St. Louis, Mo., where the immense task of rehabilitation was undertaken. Having been built at St. Louis Ship., the *Meriwether Lewis* was familiar to most of the workers in the yard but few of these workers, except those who had been sent to assist in the raising, were prepared for the destruction accomplished by Old Man River. Drydocking revealed the large hole torn in the hull but repairs to this was easily accomplished. The superhuman job was removing the tons of sand and mud deposited in the hull and superstructure. No single place on the vessel was free of sand for even the oil grooves in the main engine bearings were tightly packed. Every piece of machinery had to be torn down, thoroughly cleaned, boiled in chemical solutions and then reassembled. All partitions, insulations and state-room walls had to be torn out and replaced. All wiring over the entire vessel was renewed. All piping was disassembled and cleaned before replacing. Furniture was ruined, as well as ice boxes and deep freeze, and all were renewed. Even the radar had to be returned to the factory for overhaul. When the craft left the shipyard, it was in as perfect a condition as when it departed on its maiden voyage.

Joins Tulsa, Oklahoma, Firm

Joe C. Shaw, sales engineer with the Young Radiator Company of Racine, Wisconsin, is now affiliated with the J. R. Meek Company of Tulsa, Oklahoma. Mr. Shaw has been associated with Young Radiator since 1912 and has had invaluable experience in the engineering field. He is a graduate of Purdue University, receiving a degree in mechanical engineering in 1931. The J. R. Meek Company is the exclusive distributor of Young heat transfer equipment in the Mid-Continent area. It is expected that Mr. Shaw's long familiarity with the problems of the industry plus the experience of the Meek organization will bring added service to the Mid-Continent area.

**50
YEARS
OF EXPERIENCE
AND PROGRESS**



ABOVE

Sterling Viking Diesel
9 cylinder generator
set rated at 600 KW.

LEFT

Sterling Viking Diesel
6 cylinder marine
engine with reverse
gear, rated at 665 HP
in continuous service.

Descriptive bulletins
on these and other
Sterling Viking Diesel
engines from 150
to 1000 BHP will be
sent on request.

POWER to move ships and trains, to operate machinery or to light airports, means much more than merely installing an engine.

Fifty years of experience...broad and successful experience in applying power to just about every conceivable use is one of the reasons why Sterling engines are held in such high regard the world over.

Engineering progress is a second reason for Sterling preference. The best evidence of what constitutes success in engine design and performance is when customers come back for more.

We have the present day orders, facts and figures to show every marine and industrial user of power that Sterling's first 50 years marks just the beginning. Talk to a Sterling Engineer.



Sterling
MARINE AND INDUSTRIAL
ENGINES

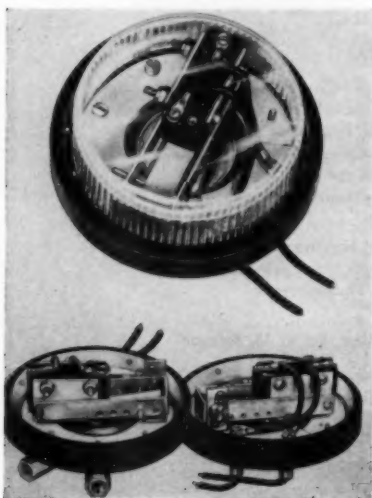
STERLING ENGINE COMPANY • 1270 Niagara Street • Telephone LIncoln 0382 • Buffalo 13, New York

● Depend upon Sterling
Diesel Power for
Locomotives, Generator
Sets, Commercial and
Fishing Craft, Lift Bridges,
Ventilating Systems,
Drilling Rigs, Etc.

Contracts for Equipment Rehabilitation

The Bureau of Yards and Docks of the United States Navy has directed Shepherd Tractor & Equipment Co. of Los Angeles to proceed with the rehabilitation of 228 pieces of heavy duty construction equipment out of Port Hueneme, California. The work involves a contract well in excess of one million dollars and covers the repair and rebuilding of earthmoving equipment to be used by the Seabees in their activities. In commenting on the award, W. W. Shepherd, general manager of the Shepherd organization, reported that organizational plans already prepared would be put into effect so that the assignment could be completed expeditiously. "We are particularly proud of the receipt of this award," said Mr. Shepherd, "and we are appreciative of the business-like way this negotiation was handled by the United States Navy. This work involves a substantial increase in our shop personnel and a relocation of some of our normal civilian activities, so that our regular customers will continue to receive the same prompt service to which they have become accustomed." The rehabilitation covers a variety of construction equipment of various manufacture, including tractors of all sizes, motor graders, power shovels, etc. Terms of the award calls for completion of the program within one year.

Pressure Actuated Switch



A new low pressure, moderately priced pressure actuated switch designed to respond to the slightest change in pressure is now being manufactured by F. W. Dwyer Manufacturing Co. According to the manufacturer, this switch is extremely accurate for indicating pressure drops in air filters, across coils, to indicate power or blower failure, actuating motors on automatic air equipment, to warn against unsafe or uneconomical operating conditions in forced air feed and boiler draft, and used with pitot static head to indicate air velocities above or below standard or safe values. The slack diaphragm of this actuated switch is linked to a beryllium copper spring with a high sensitivity micro-switch which is actuated by pressure from the

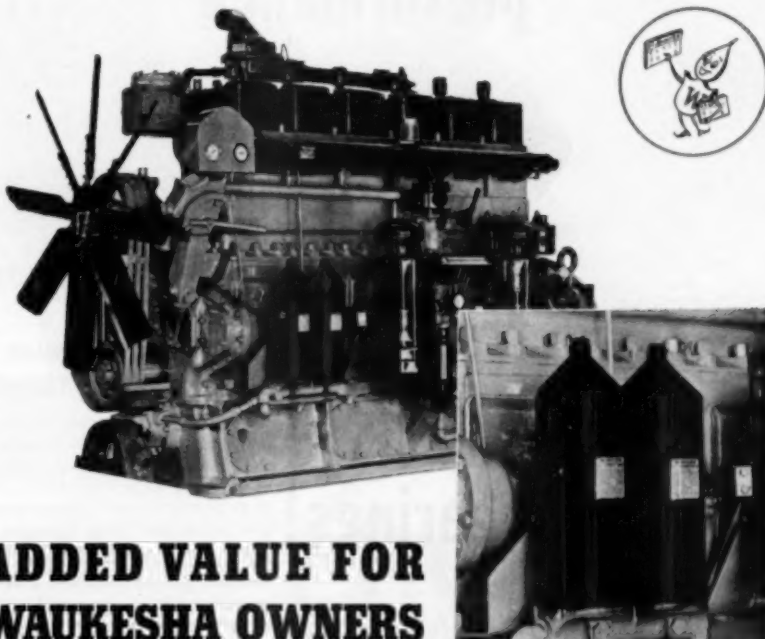
spring. The micro-switch is rated at 10 amperes, 110 volt ac. It is capable of operation on plus, minus or differential pressures up to 4 inches of water for standard models.

This switch is made in two models. Model No. 1620 (illustrated) has a 4½ inch diameter with a minimum setting of .25 inches water with a gap between the make and break pressure of .20 inches water or greater. Model No. 1625 has a seven inch diameter with a minimum gap between the make and break pressures of .05 inches water in the lower settings, 10 percent or more of the setting in the higher ranges. Switches may be mounted in any position. Full adjustment of the switch may be made in the field—both maximum and minimum

settings and the pressure gap between the make and the break. Settings are accurately maintained through thousands of cycles within plus and minus 3 percent. For further information about this new pressure actuated switch, write DIESEL PROGRESS, File No. 81, P. O. Box 8458, Cole Station, Los Angeles 46, California.

Fire Causes Million Dollar Damage

A fire which caused an estimated one million dollars damage raged through a warehouse owned by Stewart & Stevenson Services in Houston, Texas. Many diesel engines and other valuable equipment were destroyed. The fire started in a cold room where airplane and diesel engines were tested.



ADDED VALUE FOR WAUKESHA OWNERS

WINSLOW Full-Flow Filters Approved for Certain Engines

Here is a Winslow Lubricating Oil Conditioner, Model 1664-B-51, as installed on a Model 6-LRO Waukesha heavy duty gas engine built for oil field drilling, cotton ginning, irrigation pumping and other uses.

Waukesha Motor Company, whose name has been synonymous with quality and dependability on heavy duty diesel, gasoline and natural gas engines for almost half a century, has approved the installation of full-flow Winslow Filters as standard equipment on some of its engine models. To the owners of these engines, this is an important added value. With these positive in-line full-flow filters giving 100% protection to bearings and other moving parts, the added value takes many forms—longer engine life, economical freedom from break-downs and repairs, and sharply reduced costs in both money and man-hours. Whether your engine is large or small, old or new, give it the added value of Winslow Filters!

A COPY OF OUR FREE BOOKLET, "THE CASE OF THE DIRTY DRIP," IS YOURS ON REQUEST

WINSLOW FILTERS

312-MCH-1

Winslow Engineering Company • 4069 Hollis Street • Oakland 8, California

**better
diesel
performance**



**from
better
bearings!**

**COPPER-LEAD BEARINGS TO MEET
EVERY DIESEL OPERATING NEED**

We have developed a range of special Diesel Copper-Lead alloys that meet nearly every performance requirement, from truck engines to large railroad and marine applications. Each alloy is tailored to a specific range of usefulness. For example, Federaloy H-24 and H-35 meet requirements within the high speed truck and tractor field, while Federaloy B-40 is turning in top performance records on railroad Diesels.

Whether you are faced with a new Diesel bearing design, or a re-design job . . . or a real operating problem, why not get the experienced opinions of our engineers? They know the field and are glad to help.

FEDERAL-MOGUL CORPORATION, 11039 Shoemaker, Detroit 13, Michigan



SINCE 1899
Our six plants produce
sleeve bearings in all designs
and sizes; cast bronze
bearings; rolled split-type
bearings; bi-metallic rolled
bearings; washers; spacer
shims; precision bronze
parts and bronze bars.

FEDERAL-MOGUL *Copper-Lead* **DIESEL BEARINGS**

*VISCOSITY



All equipment will last longer — give better service — if you use the proper lubricant. That's why you'll find it profitable to use Tycol high quality oils and greases.

There's a reason! No matter what your lubrication need — for roll neck bearings or mine cars, Diesels or high speed textile spindles, turbines, paper calenders or steam engines . . . where *VISCOSITY, penetration, extreme pressure is a factor — Tycol has a lubricant suited to your specific requirements.

Refined from selected crudes, Tycol lubricants are exceptionally resistant to breakdown which means greater economy . . . longer life for every type of equipment.

Let us show you the extra value in every measure of Tycol lubricants. Write your nearest Tide Water Associated office today.



Boston • Charlotte, N. C. • Pittsburgh • Philadelphia • Chicago
Detroit • Tulsa • Cleveland
San Francisco • Toronto, Canada



*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA"
This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

More Compact, Lighter, Oil and Water Cooler

A new design of oil and water coolers is described in a bulletin recently published by the Griscom-Russell Co. The unit, known as the LK-Fin Cooler, is distinguished by the use of helically-finned heat transfer elements instead of conventional bare tubes. The bulletin explains how the LK-Fin elements provide a lighter, more compact and less costly unit for a given cooling service, and diagrams show comparisons of length and number of tubes and size of units for equivalent heat transfer surface. The bulletin also describes and illustrates the design details which provide most effective heat transfer, permit free expansion of the tube bundle,

prevent interleakage and leakage to the outside, promote convenience of inspection and cleaning.

Complete selection data are given for various ranges of duties, together with dimensions and specifications for standard sizes. The units are particularly adapted to services such as cooling diesel engine jacket water, lubricating oil, transformer oil and quenching oil, according to the manufacturer. The design is based on the Griscom-Russell experience of many years of building finned-tube heat transfer apparatus. For copies of this interesting and well written bulletin send your request to The Griscom-Russell Co., 285 Madison Ave., New York 17, N.Y. Ask for bulletin No. 1020.



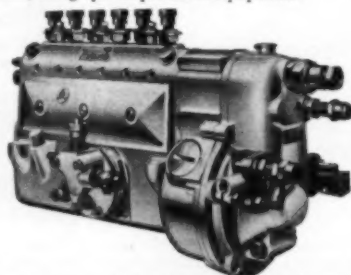
Confidence Abroad



Transport operators all over the world have learnt to trust this sign.

In any language the letters on the C.A.V. sign stand for first-rate service facilities, maintained by highly-trained craftsmen, using special precision equipment.

Wherever vehicles fitted with C.A.V. Fuel Injection Equipment are exported—whether to Trondheim, Santiago, Hong-Kong or Sydney—there's a service agent or depot to give it the specialist attention needed for such high-precision equipment.



Fuel Injection and Electrical Equipment

Service Depots throughout the World

C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC., NEW YORK 19, N. Y.

Sales Office:

14820 DETROIT AVENUE, CLEVELAND 7, OHIO

Why America needs

more

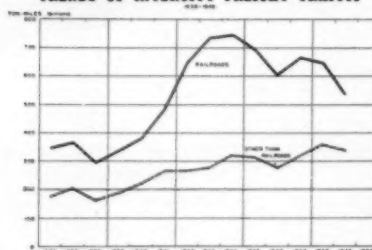
Diesel Locomotives

now

The Diesel Locomotive is one of America's most important defense tools
Railroads bear the brunt of defense transportation requirements

Of the total increase of 330 billion ton-miles in intercity freight traffic during the war years, 1941 to 1946—the railroads handled 82%—all other agencies 17%

TRENDS OF INTERCITY FREIGHT TRAFFIC



Railroads had 5,201 fewer freight and passenger Locomotives in service during 1950 than they had in 1940

1940



28,899 STEAM + 104 DIESEL = 29,003

1950



19,868 STEAM + 3,934 DIESEL = 23,802


DIESEL PROGRESS

With 18% fewer Locomotives, Railroads are doing 30% more work by using Diesels

	1940	1950
Locomotives	29,003	23,802
Gross ton-miles of freight	973,106,160	1,294,604,673*
Passenger train car miles	3,011,634,451	3,004,035,515*



* Nine months projected

Although Diesels number less than 17% of the total freight locomotives, they are doing 44% of the work In September 1950




17% handled 53,418,888 MGTM or 44%


83% handled 67,988,984 MGTM or 56%

DIESELS haul 25% more tonnage 33% faster
A typical Steam freight locomotive

hauls 
 15 miles in one hour

A typical Diesel freight locomotive

hauls 
 20 miles in one hour

The Diesel's greater hauling capacity enables Railroads to handle more tons with fewer trains...and that means...

New Line of Oil Reclaimers

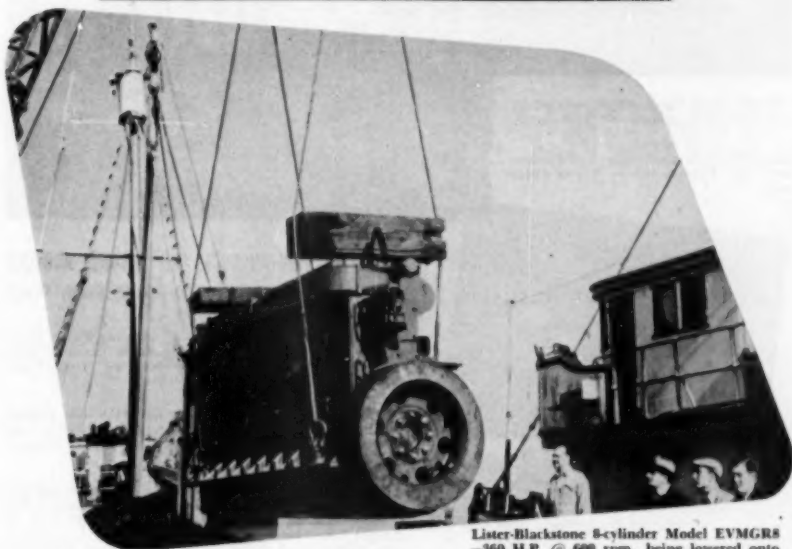
Hilliard has announced a new line of Hilco oil reclaimers. The new line of units features improved design including rotary type pumps, high capacity regenerative heat exchanger, new vacuum pump lubricating system and general re-arrangement for ease of servicing and longer equipment life. Now in production and in service the re-designed units have been giving good performance. Hilco oil reclaimers are



used extensively for the reclamation of diesel and gas engine compressor lubricating oils. The process consists of first filtering your oil through a bed of Hilite Fuller's earth for straight-run mineral oils or Adstay filter discs for heavy-duty detergent type oils. After filtering the oil flows into a vaporizer where all traces of water, moisture and fuel dilution are removed and then the oil passes through the high capacity regenerative heat exchanger where heat is transferred to the cold incoming oil. The vapors resulting from the condensation of water and fuel dilution pass to a distillate receiving tank. These units are available in capacities ranging from two gallons up to 500 gallons per hour. For further information write to the Hilliard Corporation, Elmira, New York.

360 WORK-HORSES GOING BELOW! In Goes **ANOTHER** BIG

Sister-Blackstone



Lister-Blackstone 8-cylinder Model EVMGRS—360 H.P. @ 600 rpm, being lowered onto the bedplates in still another engine-room.

Atlantic-to-Pacific and Gulf-to-Great Lakes, keen buyers, powering or repowering, are going for husky Lister-Blackstone diesels.

- They last
- Low prices
- Ample spares laid down locally
- Low maintenance costs
- Coast-to-coast service
- Good delivery

LISTER-BLACKSTONE, Inc.

Factory, Sales & Service Headquarters
420 Lexington Avenue, New York 17, N.Y.
Main Parts Warehouse:
NORFOLK, VA., 109 Second Street
Boston • New York • Norfolk • New Orleans • St. Louis • Mobile
Tampa • Miami • Jacksonville • San Antonio • Dallas • Houston
Newport (Iowa) • Charleston (Pa.) • Seattle • Long Beach (Cal.)
San Francisco • San Diego • Montreal • Toronto • Winnipeg
Vancouver
Sold and Serviced in 37 Countries Throughout the World

Arranges For Australian Production

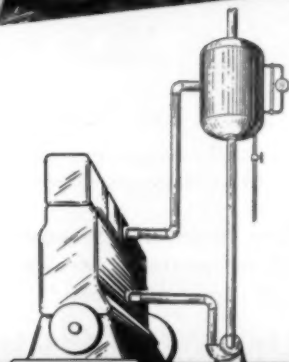
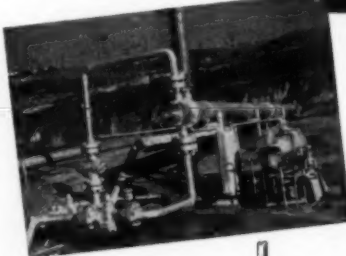
Mr. B. A. Dollens, vice-president of General Motors and general manager of Electro-Motive Division has revealed that the production of diesel-electric locomotives in Australia will commence under the arrangement concluded between Clyde Industries of Sydney, New South Wales, Australia, and the General Motors Corporation, Electro-Motive Division, La Grange, Illinois. The start of production will be the culmination of two years of development work including the study of the motive power requirements of Australian railways and the design of a special model to fit these requirements plus the requirements for economic manufacture in Australia. Initial orders cover 11 locomotives, 1500

hp., 6 axle, 4 motor type for the Commonwealth Railways, Australia, and 17 locomotives, 1500 hp., 6 axle, 6 motor type for the Victorian Railways. The total weight of the locomotive approximates 100 tons in either case. Engine and power transmission equipment will be produced at the La Grange works of Electro-Motive and shipped to Australia, and there assembled in locomotives built by Clyde at Granville. It is expected that the first locomotive will be running in Australia before the end of the year, and it is hoped that, embodying the proven experience of many thousands of locomotives on the American railroads, they will set a new standard in performance and economy for Australian railroads.



ABOVE—This Vapor Phase unit eliminated need for costly cooling tower shown.

BELOW—Heat Exchanger and Condensate Hot Well served by Vapor Phase unit.



VAPOR PHASE pays off in Savings alone, the first year. The unit costs nothing to operate and is good for life.

VAPOR PHASE Solves Pump Oil Heating Problem in Major Oil Field

—AND KEEPS THESE 11 GAS ENGINES AT CONSTANT PEAK OPERATING EFFICIENCY IN THIS KOBE OIL PUMPING SYSTEM POWER HOUSE.



INCREDIBLE PERFORMANCE AND SAVINGS ACCRUED SOLVES OTHER OIL FIELD PROBLEMS, TOO!

In this major West Coast oil field, amazing Vapor Phase—a single unit—is "doing the impossible" and reducing operating costs to a ridiculously new low. Here Vapor Phase serves three vital functions:

1. Keeps a battery of 11 Twin City HUA Gas Engines (500 HP) at constant peak efficiency, with lowest fuel and lube oil consumption, and unaffected by ambient temperatures or conditions.
2. Provides steam at 10 psi 240° F.—1500 gph or 1,429,500 btu's per hour at full load—used to heat the Kobe System lifting oil. (Kobe oil at 3500 psi passes through heat exchanger tubes heated by steam. Condensate is automatically collected in hot well for return to Vapor Phase unit without loss.)
3. Eliminates costly cooling tower formerly used.

AND THAT'S NOT ALL!

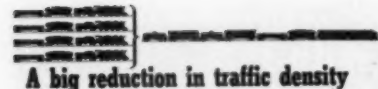
Vapor Phase equipped engines also serve the multi-purpose job of generating steam, heating water, fluids, space or other process (including cooling or heating through air conditioning systems)—each as required or all at the same time for the cost of engine operation only.



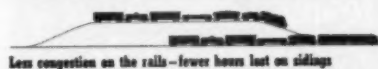
STOP THROWING GOOD MONEY AWAY!
WRITE OR WIRE FOR INFORMATION

Offices in Most Principal Cities

ENGINEERING CONTROLS, Inc.
2835 East Eleventh St., Los Angeles 23



A big reduction in traffic density



Less congestion on the rails—fewer hours lost on sidings



More rapid movement of food, munitions and supplies

Faster Diesel Freight movement gets more work from every freight car

In 1945, with steam operation, one Class 1 railroad averaged 707 net ton-miles per freight car day.

In 1949, with complete Dieselization, this railroad averaged 1035 net ton-miles per freight car day—a 35% increase in freight car utilization.

With Diesel Motive Power 3 freight cars



can do the work of 4



A Diesel Locomotive does as much

work on **1** of fuel oil



As a Steam Locomotive does on

8 of coal



Saving in fuel haulage releases thousands of cars for vital service and reduces congestion on the rails

Diesel dynamic brakes

save millions of pounds of iron

every year

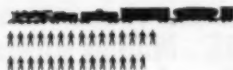
Actual records show that dynamic braking saves over three-quarters of a ton of iron brake shoes on one 4,500-mile round trip of the Santa Fe El Capitan—a saving of more than 300 tons a year for just one 13-car passenger train.

DIESEL PROGRESS

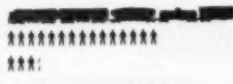
Because most Diesel freight locomotives are also equipped with dynamic brakes, the saving in brake shoes totals many thousands of tons of iron every year.

Diesel operation increases man-power efficiency almost 200%

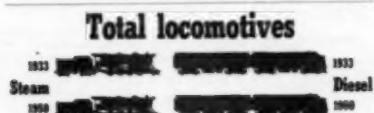
In 1946, with steam operation, one Class 1 railroad employed 2,775 transportation and maintenance employees to handle 24,871 gross ton-miles per train-hour—12.2 per man.



In 1946, with complete dieselization, this same railroad employed 1,400 transportation and maintenance employees to handle 24,871 gross ton-miles per train-hour—17.8 per man.



Since 1933 more than 27,000 steam locomotives have been scrapped



52% of all steam locomotives are over 30 years old

Anticipating Diesel replacements, railroads have deferred heavy repairs on many of these obsolete units.

Continued rehabilitation of obsolete steam locomotives requires a supply of skilled man power which the railroads DO NOT HAVE

Large numbers of able mechanics leave the railroads for other jobs and facilities to others for temporary employment.



Pipefitter



Boilermaker



Sheetmetal



Machinist

The Railroad Retirement Board estimates that railroads were short approximately 4,000 skilled trades journeymen in January, 1951.

Distributor Appointed

Yaun Equipment Company, 2120 North Third Street, Baton Rouge, Louisiana, has been appointed distributor for Nordberg 4FS diesel engines in the southern half of Louisiana according to an announcement by the Nordberg Manufacturing Company of Milwaukee, Wisconsin. The new distributing organization was established in 1921 by J. F. Yaun who owned and manufactured a patented all welded steel dragline bucket. Mr. J. Clifton Yaun is now president of the company and Huey F. Yaun is first vice-president. Mr. J. D. Ganey is secretary-treasurer and J. H. Loupe is sales manager. In addition to the dragline bucket, Yaun Equipment now manufactures sugar mill

equipment, maintaining excellent facilities for sales and service of all equipment. The Nordberg 4FS diesels are built in one and two cylinder models ranging in power from 10 to 30 hp. within an operating speed range of 1200 to 1800 rpm. Designed for stationary or power plant applications, these four-cycle, heavy-duty vertical engines are offered as complete, self-contained, ready to operate electric generator sets, centrifugal pump units and with clutch or stub shaft power take-off for direct connection or belt drive.

DIESEL ENGINE CATALOG is now available in its Fifteenth Edition. Completely revised and up-to-date, it is invaluable to design engineers and buyers. ORDER COUPON ON PAGE 26.



Eaton engineers will welcome the opportunity to discuss the application of Eaton valves to engines now in design or in production.

For more than 30 years Eaton has been privileged to cooperate with the country's leading Diesel engine builders in furnishing valves and other valve train parts. These engine manufacturers have found that Eaton's broad experience in the Diesel engine field and Eaton's understanding of the problems peculiar to Diesel engineering, are as valuable to them as the quality of the valves produced.

EATON MANUFACTURING COMPANY
CLEVELAND, OHIO
VALVE DIVISION: 9771 FRENCH ROAD • DETROIT 13, MICHIGAN

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings • Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamic Drives, Brakes, Dynamometers

New Loading Resistors

A new portable loading resistor (type 17EM55D2) for load testing diesel-electric locomotives up to 2500 horsepower has been announced by the General Electric Company's Locomotive and Car Equipment Divisions at Erie, Pennsylvania. The resistor is rated at 3450 amperes continuous, and 4000 amperes for 15 minutes. The unit was designed for run-in tests, "running-in" new bearings and similar parts, setting generator current limit, and setting diesel horsepower obtained over the constant horsepower portion of the generator characteristics. The new resistor is a completely self-contained unit requiring no external mechanical, liquid or electrical connections except the power

cables connecting the locomotive and resistor.

Resistor loading is constant, not varying from cold to hot. Mounted, the loading resistor is easily moved by a battery truck and can be used indoors or outdoors. To operate the resistor, the operator selects a desired resistance step by closing the proper switches on the switch panel. The power plant is then started and brought up to speed and readings are made from the instruments to determine output. Before changing to a different resistance step, the power plant is idled so switching is not done under load. All generator fields or main shunts should be included in the load test circuit to properly control characteristic.

STANDS UP
at
High Temperatures

D-X
DHD
MOTOR OIL
with
EXTRINOL

High summer heat plus high engine heat are a double threat to efficient Diesel operation. That's why more and more Diesel operators are changing to D-X DHD Motor Oil with Extrinol. It *stands up* at high temperatures and under high pressures.

A complete line of D-X industrial lubricants is available for every need. If you are located in the Middle West, let a D-X Lubrication Engineer help you with your Diesel lubrication and maintenance problems. Call your nearest D-X bulk station or distributor, or write direct.



MID-CONTINENT PETROLEUM CORPORATION
TULSA, OKLA.

Waterloo, Ia.

Terre Haute, Ind.

Omaha, Neb.

Chicago, Ill.

Minneapolis, Minn.

Diesel locomotives save manpower



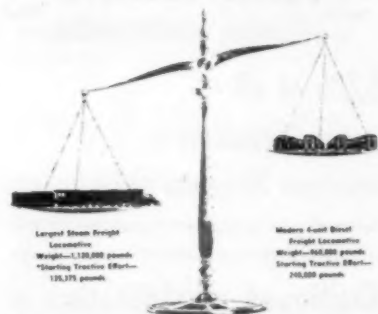
For repair and servicing locomotives on any freight operation it takes only **ONE MAN** for Diesel power for every five men required by steam power.

An estimated **21 Million manhours** are used each month for the maintenance of steam locomotives. **15½ Million manhours** could be Saved if all the work on the American railroads was done by Diesels.





Incidentally..

To do the job now being done by Diesels would require steam locomotives of such tremendous size and weight that a great many miles of track and bridges would have to be completely rebuilt to accommodate them, necessitating further expenditures of manpower and materials that are in short supply.

Besides, a great many roads would have to reestablish facilities for maintaining and operating steam power, once again with additional expenditures of manpower and materials.



Each Diesel Locomotive displaces an average of **2.8 Steam Locomotives...**
which will not need to be rebuilt

Every  of steel put into Diesel locomotive manufacture recovers at least    of scrap in displaced steam locomotives

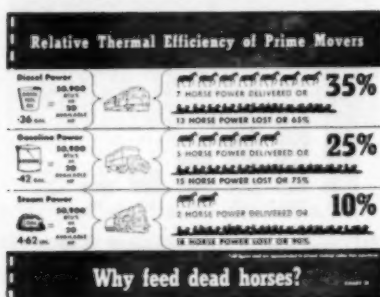
DIESEL PROGRESS

On the completely dieselized Chicago Great Western—
120 Diesel units weighing 29,900,000 pounds displaced
154 steam engines weighing 80,730,000 pounds—3.7 times


On the almost completely dieselized Central of Georgia—
74 Diesel units weighing 17,570,000 pounds displaced
120 steam engines weighing 49,873,750 pounds—again 3.7 times


...and you can't make steel
without scrap

The Diesel Locomotive actually
conserves Petroleum because
it does more work
on fewer units of fuel



In 1949, total consumption of all
petroleum products was about 5½
million barrels per day.
Of this total railroads used 4.4%.
Diesel locomotives used
only 1.6%.

 163,000 bbls.
per day
Heavy fuel for oil-burning steam locomotives

 93,000 bbls.
per day
Diesel fuel for all diesel locomotives

Total 256,000 bbls.
per day

Using 163,000 barrels of heavy fuel,
oil-burning Steam Locomotives per-
formed approximately 13% of the work

Using 93,000 barrels of Diesel fuel,
Diesel Locomotives did 40% of the work

The balance—some 47%—was handled
by coal-burning steam and electric
locomotives

Establishes Separate Sales Division

DeLuxe Products Corporation of LaPorte, Indiana, has established a separate Oil Filter and Industrial Sales Division on its line of gasoline and diesel engine oil filters and replacement cartridges, according to an announcement from John L. Engles, vice-president of the company. The new sales division will be headed by J. F. "Jimmie" Austin of Dallas, Texas, formerly representative of the DeLuxe organization in the southwestern area. The division will operate under the general supervision of R. E. Archer, DeLuxe oil filter sales manager. The purpose of the new division will be to strengthen and expand the DeLuxe oil filter service to users of vehicle and stationary gasoline and

diesel engines in the oil producing, cotton, lumber and industrial fields.

Small Craft Diesel Installations

Mr. H. J. Keizer, west coast sales and engineering representative for Lister-Blackstone, Inc., has revealed three Lister diesel boat installations in the San Francisco area. They are a Model 3JPMGR 3-cylinder Lister in the *Wiki-Wiki*, a 40-foot fishing boat; a Model 4JPMGR 4-cylinder Lister in the 45-foot steel fishing boat, the *Alle, O*; and a Model 616-MGR-5 6-cylinder Lister developing 63½ hp. in the sport fishing boat *My Pride*. The engines were furnished by Hall-Young Company of San Francisco, California.

Now OVER A MILLION HORSEPOWER

Production Of These Money-Saving
Outboard Propulsion Units Now
Exceeds A Million H.P.

YES, Harbormaster power has now passed the million horsepower mark, and is continuing to increase fast.

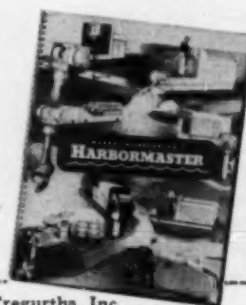
The increasing use of Harbormaster Outboard Propulsion And Steering Units demonstrates the growing realization by the marine industry of the inherent advantages of outboard power. It will pay you to investigate these advantages the very next time marine motors are up for discussion.

The Harbormaster Unit gives you a new high peak of efficiency for powering barges, towboats, tugs, lighters, derricks, ferries, etc. Marine operators find that they save thousands of dollars by using the Harbormaster, because of its rugged efficiency plus the natural advantages of the outboard propulsion method.

How fast can you get there, and how much pay load can you carry? In the great majority of cases you will find the best answer in the Harbormaster. You get the ultimate in maneuverability with Harbormaster, which allows you to steer instantly with full power in any direction through the patented M&T 360° Propellor Thrust Steering Control. You get tremendous savings in fuel because you have more thrust per horsepower.

Important features that save time and money include exclusive 180° Elevating Mechanism which allows 1-man operator to easily maintain and service the equipment; and Patented Shear Pin, which automatically shears off should underwater assembly strike a submerged obstacle, thus opening up vast new shallow water fields. Harbormaster models, for all marine purposes, are available in sizes from 20 to 300 h.p. engines, gas or diesel power.

You'll find this data, and further valuable information, in our comprehensive catalog containing over 70 photos and diagrams. Gladly sent you on request, whether you have immediate or future use for Harbormaster units. Why not write for the catalog now so that you will have full information on file?



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Please send catalog, without obligation, covering the HARBORMASTER Outboard Propulsion And Steering Unit.

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Corrosion

- Inexpensive chemical corrosion inhibitors that form a self healing protective film.

In most instances, only small quantities of Mutual Chromates are needed in solution to maintain this continuing film-like protection of exposed metals indefinitely . . . and at a very nominal cost!

Write for complete information about the chromate corrosion applications in the following: locomotive diesels, marine diesels, and stationary diesels, power plants and pumping stations.

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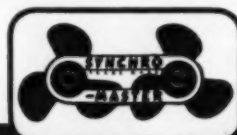
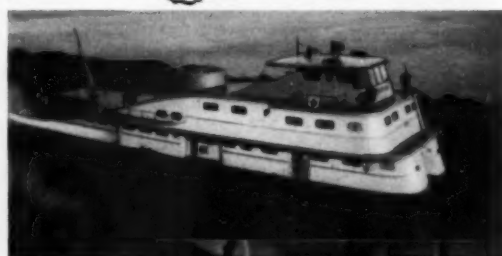


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Address inquiries to %Proportioneers, Inc.%, Synchro-Master Division, P. O. Box 1442, Providence 1, R. I.



% PROPORTIONEERS, INC. %

SYNCHRO-MASTER DIVISION

If all the work had been done by Diesels in 1949,* consumption of Diesel fuel would have been about 231,000 barrels a day

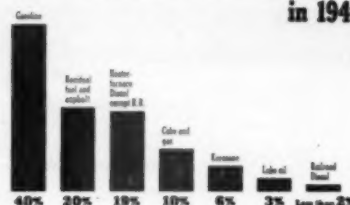
*Class I railroads, including switching and terminal.

That is 25,000 barrels per day less than the total petroleum actually consumed by the railroads in 1949

Source: U.S.C. Bureau of Census, 1950, 1951

In addition, 62,015,154 tons of coal would have been saved

Division of Liquid Fuel Consumption in 1949



Diesel fuel consumed by Railroads in 1949 was Less than 2% of the total consumption of all petroleum products

In 1950, the volume of fuel oil used for Heating was 5 times that used by Railways

Actual and estimated use of Fuel Oil (Thousands of barrels per day)

Year	Railway Diesel Use**	Heating Use*
1949	93.2	512.1
1950	122.3	610.4
1951	153.0	661.6
1952	183.8	712.9
1953	214.6	764.2

Editor's Note: This graphic, forceful presentation of WHY AMERICA NEEDS MORE DIESEL LOCOMOTIVES was prepared by the Electro-Motive Division of General Motors Corporation, LaGrange, Ill. A booklet containing all these graphs will be mailed on application. All figures based on authoritative statistical sources.

If fuel oil used for heating in 1950 had been allocated on the same basis as during the last war, 25% would have been saved.

This saving would more than cover the Railroads' entire Diesel fuel requirements for the year

Moreover, continued expansion of the natural gas industry...and accelerated conversion from Oil to Gas for heating...could make available an estimated 118,000 more barrels per day of fuel oil in 1953 than in 1950.

If the locomotive industry continues at its 1950 rate of production—3400 diesel locomotive units per year—in 1951, 1952 and 1953, diesel locomotives in service in 1953 will use an estimated 214,000 barrels of fuel per day

That is only 3% of the petroleum industry's anticipated total production of 7 million barrels per day

America needs more Diesel Locomotives now because:

- ★ Diesel enables railroads to handle growing traffic.
- ★ Diesel fuel burner trains on faster schedules.
- ★ Diesel requires less maintenance.
- ★ Diesel get more work from available freight cars.
- ★ Diesel actually save fuel.
- ★ Diesel release thousands of flat cars.
- ★ Diesel cut manpower requirements.
- ★ Diesel save iron and steel.
- ★ Diesel reduce railroad congestion.
- ★ Diesel speed movement of military and civilian supplies.

PREPAREDNESS IS EVERYONE'S BUSINESS

TRANSPORTATION IS EVERYONE'S NECESSITY

Chief Development Engineer

The appointment of Paul S. Shirley as chief development engineer, Heavy Machinery Division has been announced by R. W. Bayerlein, vice-president, Heavy Machinery Division, Nordberg Manufacturing Company, Milwaukee 7, Wisconsin. Prior to joining Nordberg, Mr. Shirley was chief research engineer at Baldwin-Lima-Hamilton. Born in Springfield, Ohio, he graduated from Ohio State University in



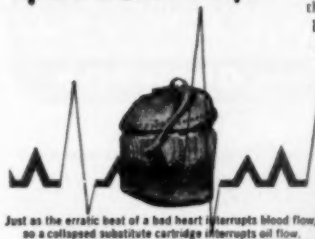
Paul S. Shirley

1929 with a degree in mechanical engineering. Following his graduation, he joined National Supply Company as test engineer and was later placed in charge of all experimental work and testing of diesel and gas engines. He left National Supply in 1936 and became associated with General Machinery Corporation, now Baldwin-Lima-Hamilton, as diesel engineer. In 1949, he was named chief research engineer, a position he held until March 1951 when he joined Nordberg Manufacturing Company.

DIESEL ENGINE CATALOG is now available in its Fifteenth Edition. Completely revised and up-to-date, it is invaluable to design engineers and buyers. ORDER COUPON ON PAGE 26.

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Just as the erratic beat of a bad heart interrupts blood flow, so a collapsed substitute cartridge interrupts oil flow.



at only 40 lbs. pressure unsupported cartridge COLLAPSES!

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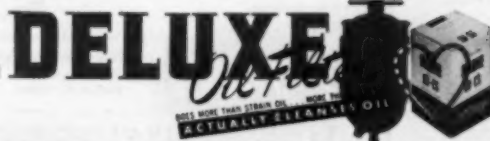
the **CONE** is essential to Long Flow Filtration.

The patented DeLuxe Cone reverses the direction of oil flow to feed oil from bottom-to-top for FULL-DEPTH Filtration. All of the oil must be in contact with the filtering medium long enough to absorb the sludge-forming impurities. In addition, the Cone permits deposits of heavy impurities and water to drop to the sump where they will not clog and shorten cartridge life.



THE MEN WHO KNOW

THE ANSWERS, INSIST ON



BUS OPERATORS ARE MEN WHO KNOW! Year after year they vote DeLuxe the Number One Filter as indicated by the Winners of Bus Transportation Maintenance Awards. Of 21 winners in 1950, 17 were DeLuxe Users. Year after year it's the same story.

THE MERLIN SERVICE MASTER

The Merlin Service Master, manufactured in England, is a self-contained unit for the complete servicing and maintenance of all types of diesel injection systems, whereby all injector needles and nozzle seats are accurately restored to their original angles as supplied by the manufacturers when new. It is designed to deal with all types of laps used in the rectification of fuel injection equipment and provision has been made to vary the seating angles between 52° and 68° to within 1 minute of a degree. The special attachments for work of this nature have been designed in close cooperation with the leading fuel injection equipment manufacturers, and additional experience with the British War Office has shown that, in its standard form the Merlin Service Master can deal with all types and sizes of fuel injection equipment normally encountered in services.

It is constructed throughout to very fine precision limits and incorporates the following individually selected and fitted refinements. All slideways are made to high precision limits and additional spring loadings have been added. Double back to back angular contact ball races are fitted in the wheel head spindle, thus enabling this pre-loaded spindle to run for a considerable period without adjustment although adequate adjustment is provided.

A four-jaw independent chuck is fitted to ensure the part being presented is set dead true to the wheel. This chuck is easily removed and a disc type face plate is supplied for carrying the rubber friction drive to the laps. This increases the lap length capacity by an extra 2½ in. to 3 in. The anvil is fitted with a ¾ in. adjustable high speed



tool steel stop which may be revolved or elongated as required. The work head is provided with adjustment to the spring tensioning device enabling the rubber friction drive to be varied in accordance with the diameter of the lap without the rubber fouling the vee blocks.

A special quickly fitted attachment is supplied to fit on the wheel head spindle incorporating a micro

clock for trammelling a straight edge attached to the vee steadies. This is to ensure that the machine can be pre-set to grind an accurate angle of 60° inclusive this being the zero indicator setting, after which the Vernier adjustment can be regulated as required for different angles and guaranteed to give a predetermined setting of 1 minute of a degree irrespective of wear or atmospheric conditions. Extra grinding wheels are supplied for the grinding of cast iron and other metals. A fine quality diamond wheel dresser is mounted in line with the grinding wheel for instant and accurate truing of the wheel. An additional holder is also supplied for use on the side and faces of the wheels when being used for purposes other than lap grinding. Fitted to one end of the machine bed is a special "Merlin" type turntable carrying a ½ hp. continuously rated ball bearing motor of 1400 rpm. with double ended shafts. Mounted on one shaft is a ¾ inch capacity, Jacobs drill chuck for holding laps and nozzle needles. For easy operation of this chuck and its equipment a special twinging device is adapted allowing the motor to be set at the required position and securely locked. Mounted on the opposite shaft is an 8 inch diameter lapping plate running at a speed of 500 rpm. This is used with the lapping disc in a horizontal position whilst the motor is in a vertical position.

The Merlin Service Master has proven tremendously useful to diesel truck and bus fleet operators, to railroad diesel maintenance shops, and to large contracting operators using centralized diesel repair depots. For information on the Merlin Service Master write DIESEL PROGRESS, File 82, P.O. Box 8458, Cole Station, Los Angeles 46, California.



Binks closed-type DIESEL COOLING SYSTEMS

produce higher engine efficiency

Diesel engines may be operated at higher, more efficient temperatures with Binks Type "D" evaporative heat exchange coils, installed in a Binks natural or mechanical draft cooling tower. The Binks system is a closed one in which treated or soft water can economically be used for cooling purposes. Scale formation in jackets is eliminated. Exact temperature control is obtained. Diesel "down time" is cut. Breakdown insurance rates are lower.

SEND for Bulletin 41. Obtain full information—drawings, tables—on heat exchange coils adaptable to a variety of operating conditions.



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Synchro-Start Overspeed Governors are made for shut-down at any predetermined RPM by either opening or closing a circuit and speed can be adjusted while the engine is running.

Rotating parts of the GF's run in sealed ball bearings, lubricated for life and equipped with tachometer drive take-off.

Rotating parts of the GK's run in two oil-less bushings and are adapted to standard SAE coupling or gear drive.

All models can be mounted in any position and an angle drive attachment can be furnished for GKA and GKM.

For further information write for
Bulletins 409 and 409-A

SYNCHRO-START PRODUCTS, INC.

8151 NORTH RIDGEWAY AVENUE,
SKOKIE, ILLINOIS.

Cooper-Bessemer Engines Ordered For Aluminum Plant

The Cooper-Bessemer Corporation announced that it has received an engine contract to build forty of its largest, most modern supercharged gas engines for Reynolds Metals new, giant aluminum reduction plant to be located near Corpus Christi, Texas. This is the biggest single commercial engine order ever to be received by this 118-year-old engine builder and calls for the fastest possible construction of Cooper-Bessemer's 3700 horsepower type LSV-16-SG engines. Engine deliveries are to start in August and are to be completed by January 1952, according to Stanley E. Johnson, Cooper-Bessemer vice-president-general sales manager.

"Scheduled for completion the early part of 1952, the power plants for this new aluminum reduction project will comprise the largest electric-generating project ever to be powered by internal combustion engines," explained Mr. Johnson. "In horsepower, the project will be considerably greater than any existing aluminum reduction power plant, providing 256,000 horsepower for aluminum reduction and general needs. The gas engines to be furnished by Cooper-Bessemer are to be of the Type LSV-16-SG supercharged and spark ignited, developing 3700 horsepower at 327 rpm. and at 135 pounds bmeq." Mr. Johnson continued.

Natural gas for fuel will be furnished from nearby independent fields. When the completed power plant is in full operation, natural gas fuel will be drawn at a rate of 48 million cubic feet per day, giving some idea of the size of this one operation. As a result of supercharged gas engine development engineered by Cooper-Bessemer it has become possible to boost gas engine horsepower output 80 per cent while cutting fuel consumption as much as 30 per cent. Keeping in mind the vast quantities of natural gas to be consumed as fuel on this one power generating operation, the enormous savings in our natural resources from these successful supercharging developments become obvious. In the powering operation for this plant's needs, nine of the LSV-16-SG units will drive 2500 kw. alternating current generators furnishing current at 4160 volts, 3 phase and 60 cycle. Thirty-one units will operate 2500 kw., direct current electrolytic reduction generators furnishing 3450 amperes at 725 volts nominal rating.

The expansion of this country's aluminum producing capacity is of course being accelerated by critical needs arising in today's emergency. In the production of aluminum, approximately two pounds of bauxite are needed to produce one pound of alumina. In turn, two pounds of alumina will produce one pound of aluminum metal. Throughout the reduction operations, the immense quantities of electric power to be generated by the new power plant, are a prime requirement for the electrolytic reduction.



MAY 1951

DIESELS for operating ECONOMY

The present day trend toward diesels — both for new installations and for replacements — is largely due to operating economy and dependability.

Current installation practice is to mount them on Korfund Vibration Isolators.

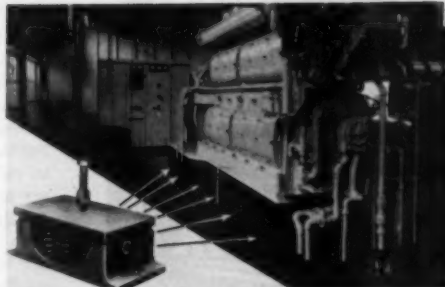
This makes it possible to install diesels anywhere with positive assurance that there will be absolutely no transmission of objectionable vibration. Additional benefits include savings from reduction of building and engine maintenance costs, and frequently the elimination of concrete foundations.

Vibration is absorbed by steel springs which provide the finest isolating medium available. Thrusts are controlled by resilient checks in the four corners.

The result is smoothed, floating operation at all speeds — in marine, mobile, or stationary installations. The cost is low. Ask for Bulletin G-102. Representatives in principal cities.

The Korfund Company, Inc.

48-208 32nd Place, Long Island City 1, N. Y.



This Alco 973 hp. six cylinder turbocharged main generating unit installed on a mooring barge operated by U.S. Army Corps of Engineers, Memphis District, supplies power for their new dragline bank grader. The unit is mounted on Korfund vibration isolators for smooth operation, and to prevent bearing misalignment due to hull distortion.

A Few Typical Installations:

Banger Hydro-Electric Co., Bangor, Me.	4 1425-hp. Nordberg
Lamar Mill Hospital, New York	1 750-hp. Worthington
2 Park Avenue, New York	4 450-hp.; 1 750-hp. Worthington
New Yorker Hotel, New York	1 130-hp.; 1 750-hp. Bosch-Lister
Numm Department Store, Brooklyn	4 300-hp.; 1 180-hp.; 1 750-hp. Worthington
Merrill's, New York	1 750-hp. Alco
Floyd Bennett Field, New York	1 450-hp. Fairbanks-Morse
Prudential Insurance Co., Newark, N. J.	1 740-hp. Baldwin
Lane Star Gas Co., Dallas, Texas	1 400-hp. Cooper-Bessemer (Incl)
San Oil Co., Marcus Hook, Pa.	4 250-hp. Ingersoll-Rand (Incl)
Cia Central Argentina De Electricidad, Buenos Aires, S. A.	1 270-hp. Sulzer; 2 540-hp.; 1 540-hp.; 1 750-hp. Deutz

KORFUND for operating SMOOTHNESS

CHECK and COMPARE THESE FEATURES

- Starting motor can be mounted more easily and in more positions.
- Requires no adjusting linkages—solenoid can be placed in any convenient position.
- Simple in design—has fewer parts—needs fewer adjustments.


It takes a truly outstanding product to receive over 85,000,000 endorsements. Yet, that's the number of Bendix Drives that have been installed. No other starter drive approaches this record of outstanding performance. That is why, whatever your type of diesel or whatever its purpose, it will pay you to specify Bendix® Starter Drive for the most economical installation and dependable performance.

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SERVING THE NATION FROM ITS CENTER

Inland River Reports

By DAVID I. DAY

THE UPPER OHIO RIVER in early April was alive with diesel towboats. The little compact 80-ft. *Bruce Walker* of the Viking Boat Company was pushing two barges of gasoline. This boat is powered with General Motors (Detroit) diesels. She has a pilot house that raises and lowers like all the towboats on the Illinois where the bridges are so low. However, the "barber chair" pilot house is a rarity on the Ohio.

WE NOTED the *Seneca* of the Cornelius Kroll Company, Houston, Texas, originally a steamboat called the *W. M. Rees* converted to diesel, 1200 hp. She was pushing southern oil. So was Pure Oil's veteran *Chas. W. Snider*, nine years busy on various waterways. And the *Keystone* of the Union Barge Line, Pittsburgh, pushing steel. All three towboats have Cooper-Bessemer engines.

OUR CONGRATULATIONS to the Walter G. Houglund Company, Paducah, Ky., on the 70% increase in pushing power of the good sturdy *Warren Houglund* now rated at over 1800 hp., with new General Motors (Cleveland) engines and new G-M auxiliary engines also. The new engines were put on at the Avondale Yards, Harvey, La., near New Orleans.

NO BETTER PUSHER has run the length of the rivers since 1941 than the *Ernest T. Weir* of the Mississippi Valley Barge Line. She has twin National Superiors generating 1300 hp. A boat of some size, 176 feet long, 36 feet wide, and 10 feet deep, she looks rather imposing back of long tows on a sunny day. We noted her just recently below Cincinnati, downbound, with six heavy barges of steel, two barges of gasoline, and a number of empties. Dravo built the *Weir* and is justly proud of this achievement.

THE NEWEST DIESEL VESSEL on the rivers is the lovely *Fort Jackson*, resplendent in green and white paint, now at work for the owners, the John I. Hay Company, Chicago. Built by St. Louis Shipbuilding & Steel Co., St. Louis, the boat is of 3200 hp., using Fairbanks-Morse twins.

Over 85% of the torque wrenches used in industry are Sturtevant.

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in inch ounces ... inch pounds ... foot pounds
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STURTEVANT TORQUE WRENCHES

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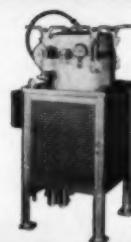
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IN CANADA — UPTON-BRADEEN-JAMES, LTD. — 990 BAY STREET, TORONTO, 3464 PARK AVE., MONTREAL



AROUND HOUSTON and the canals along the coast all seems headed for diesel power. Among the diesel vessels, some recently put in the diesel class, reported in the messages of recent days are the tug *Capt. Talfor* to receive a pair of International engines; the tug *Clydesdale* having 400 hp. General Motors engines; the new *Georgia B* is a busy tug, using General Motors diesels; the towboat *J. B. Simpson* is having General Motors 12-cylinder diesels installed; the tug *New Champion* is out with Buda engines; the right class little tug *San Diego* is using her new Enterprise 400 hp. engine; the tug *Thomas* has new General Motors diesels; and many more. (A night letter via Western Union says the Green Bayou Transportation Company is building a towboat to have twin General Motors diesels and the Texas Barge line is building two towboats probably to be similarly engaged.)

OWNERS OF DIESEL VESSELS along all the rivers are rejoicing over the news that the following is under construction—to provide more business for the boats: Fairview Collieries building a river-rail terminal at Kellogg, Ill., while the C. & E.I. Railway is doing the same at Joppa, Ill., the former on the Mississippi, the latter on the Ohio; Freeport Sulphur Company in Louisiana is building a new plant at Bay Ste. Elaine—sulphur being a vital war material.

THE FIRST APPEARANCE of the 90-ft. 900 hp. tug *Southern Cross* on the Ohio River was chronicled a week or so ago. She was pushing empty

barges when seen, her General Motors engine running quietly and smoothly. (This is not to be confused with the 40-ft. wooden tug of the same name so efficiently operating around New Orleans waters using a Caterpillar engine.)

A MIGHTY GOOD TESTIMONIAL to the merits of the Enterprise diesel engine is the M. V. *Stephen Foster* of the Butcher-Arthur fleet of Houston. She is using a 1500-hp. unit. We noted her in April going up the Mississippi, possibly to St. Paul pushing several heavy barges of oil against stiff current. This was the first time this spring we have seen this boat above St. Louis.

A NEAT LITTLE 60-FOOTER is the 550 hp. boat the *Steve Rogers* of the Massman Construction Co., Kansas City, powered with twin General Motors diesels. She is now at work as is the dredge tender *Em-Aye*, 450 hp., Gray engines, owned by the Western Contracting Corporation, Sioux City, Iowa. Both were built at the yards of the Missouri Valley Steel Co., Leavenworth, Kansas, both for Missouri River service.

WE SALUTE the *A. M. Thompson*, Enterprise-powered 3200 hp. pusher of the Central Barge Co. fleet, Chicago, one of the first up to St. Paul with coal this spring. She takes up 14 barges at a time, a payload of 18,500 tons.

DIESEL ENGINE CATALOG is now available in its Fifteenth Edition. Completely revised and up-to-date, it is invaluable to design engineers and buyers. ORDER COUPON ON PAGE 26.



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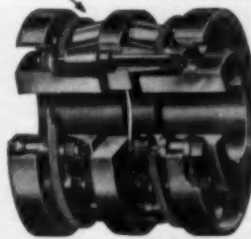
$\frac{1}{2}$ to 40,000 HP
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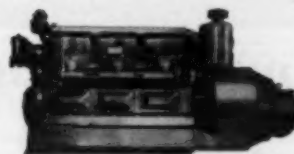
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 DRIVES, LOCOMOTIVE MAIN DRIVES,
 AUXILIARY DRIVES, ETC.

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West Coast Diesel News

By FRED M. BURT

SIX AUTOCAR, Model DC-74-T tractors, powered with Cummins 165-hp. diesel engines purchased by La Salle Trucking Co., San Diego brings their fleet of diesel-powered Autocar truck and tractors to more than 90 units.

THE MARTINOLICH Ship Repair Co., at pier 52 San Francisco since 1939, specializing in the building and repair of purse seiners and tuna clippers (diesel-powered principally), has moved to an 8.2 acre site at the foot of Fifth Ave., Oakland. Up to 2,000 people can be employed at the new plant which includes a leased, 2800 ton floating drydock.

LAUNCHED at Birchfield Boiler yard, Tacoma, (who built the hull for Tacoma Boat Bldg. Co.) Jeanne Lynn, 121 ft. steel vessel for O. W. Martin, powered with 900-hp. General Motors main diesel, Superior diesel auxiliaries.

INSTALLED by Crofton Diesel Engine Co., San Pedro branch, a 3-cyl. General Motors diesel with 3:1 hydraulic gear, to re-power Albacore vessel Ronnie F. owner Louis Francis, Terminal Island.

DENNY M. 44½ ft. seiner, built by Albert Jensen & Sons yard, Friday Harbor, for Edward Martel, was powered with an 80-hp. Caterpillar marine diesel by N-C Marine, Lake Union, Seattle.

THE 120 ft. wood tuna clipper, *Helen S* (designed by Tacoma Boat Bldg. Co.) under construction by Harbor Boat & Yacht Co., San Diego for Manuel Simas and associates, will have an Enterprise 800-hp. (@ 400-rpm.) propulsion diesel, with two 225-hp. G.M. diesel auxiliaries.

TEN STERLING truck tankers, powered with 200 hp. Cummins diesel engines, recently added to their fleet by Cantlay and Tanzola, Los Angeles, brings to a total of 16, the number of such units purchased from Sterling Truck Co., Los Angeles.

FOR the Southern California and Southern Counties gas companies' compressor plant at Blythe, two more 1760-hp. Clark compressors. Added to the previous seven 1600-hp. and five 1760-hp. Clark units, the 14 compressors will have capacity to pump about 600,000,000 cu. ft. of natural gas daily, at 810-psi, to the Los Angeles area.

FOR USE at the Del Valle gasoline plant recently purchased by Union Oil Co., an 800-hp. GMV6 Cooper-Bessemer super-charged, Turboflow, gas engine driven compressor.

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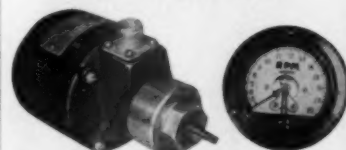
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ON THE Signal Oil & Gas Co. Bolsa lease, Huntington Beach, Calif., four 300-hp. Le Roi natural gas engines powering a slant, deep drilling rig on an off-shore well, are using Engineering Controls' Vapor Phase units for cooling in place of radiators. Low pressure steam produced drives steam turbines that turn cooling fans, with a saving of about 100-hp. overall, using waste heat rather than engine power for fans.

LAUNCHED at the Martinac yard, Tacoma, large tuna clipper *Mona Lisa*, skipper Joe Correia, is powered with 600-hp. Superior main diesel; two 100-kw General Motors diesel-electric auxiliary sets.

THE BILL JAHNS Engineering Co. which specializes in manufacturing pistons for all types of stationary and mobile diesel engines, (including the largest and the smallest, oldest and newest) has moved from its old location in Anaheim to a new plant in Costa Mesa, Calif.

REBUILT at Fishermen's Boat Shop, Everett, Wash., veteran seiner and dragger *Lualda*, was re-powered with a 120-hp. "Caterpillar" diesel turning a 52 x 43 Coolidge wheel through a new 2.96:1 Twin Disc reduction gear; auxiliary equipment includes an Onan 2-kw. generator with automatic controls. Melvin Nilson is skipper.

RE-POWERED by Van Camp Sea Foods Co., San Diego, with two 300-hp. (NHRMS-600) Cummins diesels, sport fishing boat *Spitfire*, Capt. Al Bruner. Former 63 ft. yacht, converted to combination fishing boat at Stephens Bros., Stockton, *Harriet B.* powered with two 165-hp. G.M. diesels; a 16-hp. Lister-Blackstone diesel auxiliary from Hall-Young Co., San Francisco, owner John Finetti.

HALLETT MFG. CO., reports large export sales of 1-cyl. (8-hp.) and 2-cyl. (18-hp.) industrial and marine engines, through their distributor in La Paz, Bolivia, for diversified uses including mining, agricultural, fishing and other marine uses.

TWO NEW vessels for British Columbia's fishing fleet each powered with a 500-hp. General Motors diesel—80 ft. *Nanceda*, owned by Nelson Bros. Fisheries, Captain Louis Percich; *Waldero* 75 ft. salmon-herring seiner owned and operated by Capt. Walter Carr, Vancouver.

A NEW White demonstrator bus, powered with a special adaptation of the Cummins NHHB-600, 200 hp. horizontal diesel, arrived in Los Angeles late in March. This 45 passenger, 102 inch wide, Model 1144 bus will be given thorough economy and performance tests by Pacific Electric Co., Los Angeles Transit Lines and other West Coast bus transportation systems.

THE FRIDAY Harbor Canning Company's tender *Sockeye*, at the Bellingham (Wash.) Shipyards, has just received a new house along with a new 250-hp. Cooper-Bessemer diesel propulsion engine.

INSTALLED by Shepherd Diesel Marine, San Diego, in twin *Hike II*, a 6-cyl. 80 hp. "Caterpillar" diesel with 3:1 Twin Disc reduction gear; home port Ketchikan, owner Eric Johnson.

THROUGH the Florida distributor in Jacksonville, 1-cyl. 3-hp. air-cooled Hallett marine diesel auxiliary engines, in considerable numbers are being used to power generators, compressors, etc. in many new 65 ft. shrimp boats to work the new Tortuga shrimp beds.

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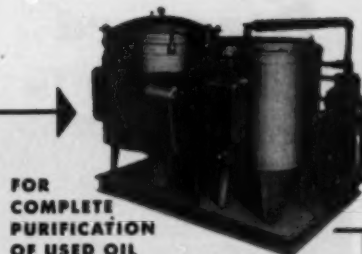
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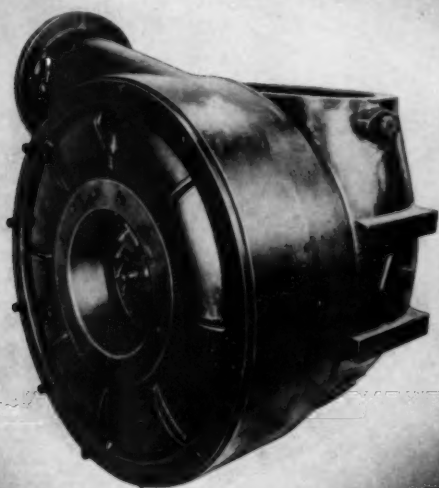
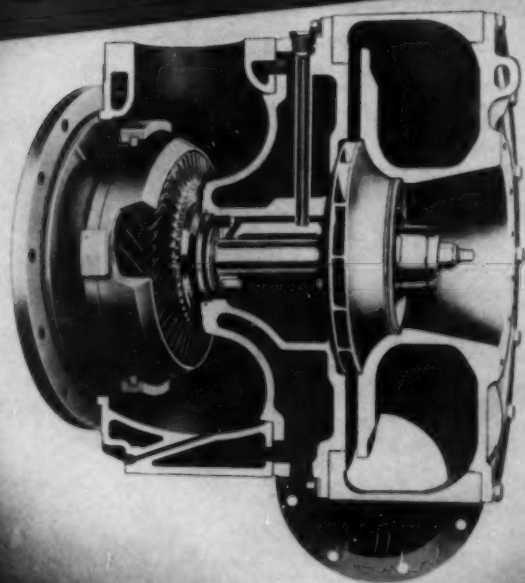
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